Phase 2 System Architecture Document

Heart of Iowa Regional Transit Agency ITS4US Deployment Project

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ITS4US

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16. Abstract

The Heart of Iowa Regional Transit Agency (HIRTA) is one of the five awardees for Phase 2 of the ITS4US program for its proposed concept *"Health Connector for the Most Vulnerable: An Inclusive Mobility Experience from Beginning to End"* (Health Connector) by the United States Department of Transportation (USDOT). Per the goals of the program, Health Connector project is focused on improving transportation access to healthcare for underserved groups in Dallas County, Iowa. This document serves as the System Architecture Document (SAD) for HIRTA. The SAD describes the system architecture from multiple architecture perspectives including the Enterprise Architecture View, Functional Architecture View, Physical Architecture View, and Communications Architecture View. This document identifies the sub-systems, internal and external interfaces, and interface standards necessary to develop the proposed Health Connector solution. Requirements for these subsystems were previously defined in the System Requirements Specification (SyRS). Further design information is detailed in the System Design Document (SDD), to be finalized in March 2023.

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1   Introduction

1.1 Document Purpose

This document serves as the System Architecture Document (SAD) for The Heart of Iowa Regional Transit Agency (HIRTA) *"Health Connector for the Most Vulnerable: An Inclusive Mobility Experience from Beginning to End"* (Health Connector) solution for the United States Department of Transportation's (USDOT) ITS4US program. The SAD describes the system architecture from multiple architecture perspectives including:

1. Enterprise Architecture View
2. Functional Architecture View
3. Physical Architecture View
4. Communications Architecture View

This document identifies the sub-systems, internal and external interfaces, and interface standards necessary to develop the proposed Health Connector solution. Requirements for these subsystems were previously defined in the System Requirements Specification (SyRS), which will be updated upon completion of the System Design Document (SDD). The SDD outlines further design information and will be finalized in March 2023. Note that the Interface Control Document (ICD) is planned as a separate document.

1.1.1 Organization of this Document

This document is organized by the following sections:

1. **Section 1. Introduction** describes the purpose of the SAD, provides an overview of the scope of the deployment project and key concepts of the deployment, and describes the approach used to create this SAD document.

2. **Section 2. Stakeholders and Concerns** defines the stakeholders, user needs, and concerns of the proposed system from Phase 1. The purpose of describing these groups for the proposed system from Phase 1 is to provide the readers with the interactions of these groups with the system and with each other. Section 2 describes the stakeholders' concerns of the System of Interest (SOI) as defined by ISO/IEC/IEEE 42010 standard.

3. **Section 3. System of Interest** provides a high-level description of the proposed SOI touching on the all the major aspects of the system. Provides the context diagram developed in Phase 1 showing the interactions between the users and subsystems. The relationships provided in the context diagram will be explored in the next section, with the SOI presented through the four major architectural views.

4. **Section 4. Architectural Views** describes the conceptual model of the proposed system by providing the four main architecture views as defined in ARC-IT v9.1 [1]. These are the Enterprise, Physical, Functional and Communication viewpoints of the proposed system. These act as a set of layered viewpoints that provide different perspectives of the SOI.

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1.2 Identifying Information

Architecture Name: HIRTA Health Connector System Architecture

System-of-Interest: HIRTA Health Connector – System of Systems

1.3 Project Scope

HIRTA provides over 300,000 customer rides and operates 95,000 hours (2019 estimates; pre-pandemic) along with 1.3 million miles of service within the seven-county region encircling the Des Moines urban area. HIRTA provides demand response services to customers for all trips booked from 24 hours to up to 14 days in advance. If capacity is available, HIRTA also provides trips to meet same day requests. HIRTA also acts as a service provider for the State of Iowa Medicaid broker, Access2Care.

HIRTA was awarded a Phase 2 agreement of the ITS4US Program for its proposed concept *"Health Connector for the Most Vulnerable: An Inclusive Mobility Experience from Beginning to End"* (Health Connector) by the United States Department of Transportation (USDOT).

Health Connector is an innovative solution that will address various bottlenecks associated with transportation access to healthcare for HIRTA communities. Some of these challenges are key reasons behind missed appointments or the unacceptable level of preventive or as-needed healthcare in the HIRTA service area. For this deployment, the HIRTA team plans to implement a scalable and replicable solution that enables inclusive access to non-emergency medical transportation for all underserved populations and their caregivers by resolving transportation access barriers with the use of advanced technologies. This solution will allow Dallas County residents without access to transportation who may be seeking a medical appointment to explore their transportation alternatives and book both medical and transportation appointments at the same time through a smart device (e.g., smartphone, smartwatch) application or equally effective alternate method. Further, this solution will include information and wayfinding services to guide them at every step of their trip.

This deployment will provide enhanced access to healthcare options for all travelers in Dallas County with a specific focus on underserved communities, including persons with disabilities, low income, rural, older adults, veterans, and persons with limited English proficiency. In addition to addressing mobility needs, the proposed deployment will recognize the net impact that access to health services has on patient healthcare outcomes as well as both the financial and health outcomes from the perspective of the healthcare community/Dallas County Health Department (DCHD).

Figure 1 provides an overview of the Health Connector concept.

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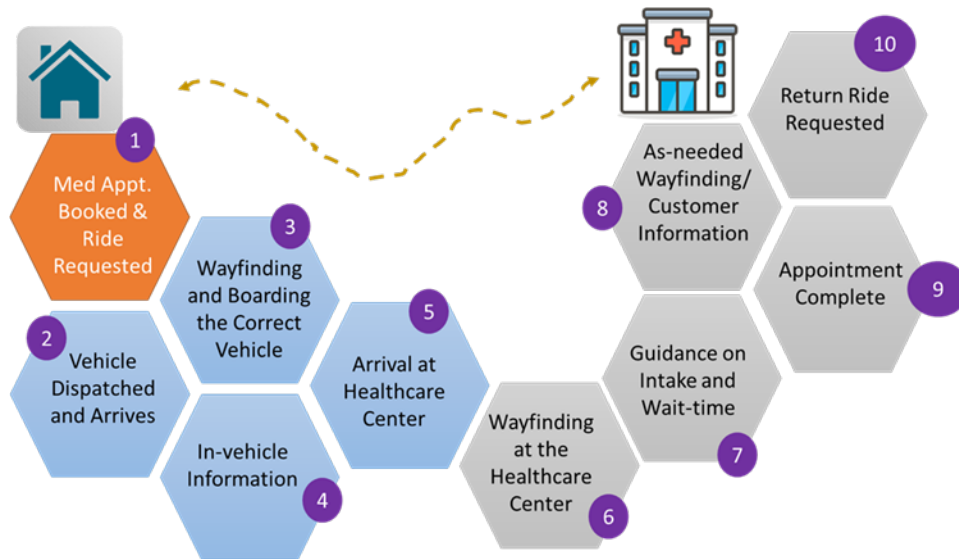
Figure 1. Overview of Health Connector (Source: HIRTA team)

For more information about the key capabilities of the proposed Health Connector technology, refer to the Phase 1 concept of operations (ConOps) and Phase 1 System Requirements Specifications (SyRS) documents [3] [6].

There are five main goals for the Health Connector Concept, which include:

- Improved health outcomes through increased access to medical transportation for Dallas County residents
- Self-reliance and spontaneity for underserved groups
- Efficient transportation management capabilities for medical transportation services
- Financial sustainability of medical transportation programs
- Safe medical transportation services

For more information regarding these goals and more detailed objectives and performance measures, please refer to the Phase 1 Performance Measurement and Evaluation Support Plan (PMESP) [2]. Throughout, 'Traveler' refers to those individuals who will use Health Connector services to access healthcare appointments.

1.4 Approach

This SAD follows the format and requirements laid out in the IEEE 42010 systems and software engineering – architecture description, which is an international standard for the documentation of the system architecture. The IEEE 42010 standard is designed to be used on large complex systems, but ARC-IT has been developed such that it can be used to define architecture for transportation system of all scale and size and include multiple modes, as applicable. However, given the specific aspects of demand response transportation and healthcare related interfaces, the authors extended the existing architecture models to reflect the actual needs and flows for the HIRTA Health Connector system.

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1.5 Rationale for Key Decisions

The architecture described in this document was developed by the project team to support HIRTA in achieving its objective to deploy emerging and innovative technologies and services through an inclusive customer-focused design process to engage stakeholders to address the mobility needs of underserved populations. The rationale for key decisions on the Health Connector system architecture developed are based on the following existing conditions and constraints identified by the HIRTA project team as defined herein:

1.5.1 HIRTA

Operational polices and constraints for HIRTA as anticipated in the context of Health Connector are as follows:

- **Hours of operation:** Currently, HIRTA's services are available 7AM-5PM Monday through Friday. Given HIRTA is planning to provide after-hours services through Health Connector, new polices will have to be developed and published by HIRTA.

  A key factor for finalizing hours of operation will be healthcare facility hours. Our understanding is that most trips will be covered during HIRTA service hours. Only under rare circumstances will trips be requested during care facility hours outside of HIRTA service hours. On such occasions, HIRTA will also have to consider third-party service providers that may be available in the area to provide after-hours services. Also, HIRTA will have to determine the need for having at least one HIRTA dispatch staff on standby to assist in the event of delays or incidents. All these factors will drive the determination of hours of operation.

  Any future changes in service hours must be automatically communicated to appropriate parties (e.g., healthcare providers, DCHD) and communicated to customers through appropriate channels.

- **Third-party service providers:** With the deployment of Health Connector, HIRTA will have the capability to partner with third-party providers for providing services after office hours. However, detailed policies and procedures will have to be developed with third-party providers when third-party agreements are finalized.

- **IT-related policies:** No major IT infrastructure-related changes are anticipated as part of this project, but partners will have to be provided access to Health Connector and HIRTA will be responsible for providing access and maintaining appropriate security and access levels for those partners. Security and access restrictions are discussed in the Phase 2 Data Privacy Plan.

- **Staffing:** The project will not result in increased staffing levels, but roles may have to be adjusted given efficiency gains observed due to reduced level of coordination per trip.

- **Budget/financial constraints:** Budgeting as determined during Phase 2/3 proposal development will be used for deployment and long-term operations.

- **Definition of standard operating procedures** (**SOPs) for Health Connector:** While Health Connector will be part of HIRTA's demand response service, detailed SOPs will have to be developed, describing roles and responsibilities and organizational structure prior to system launch during Phase 2. This process will begin in Task 2-B during system design, and will be finalized during Task 2-L.

- **Service level agreements (SLAs):** The following types of SLAs will have to be developed:

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o SLAs with vendors will have to be made available for providing Health Connector service to meet the required system performance needs. ConOps will be updated once these are finalized during Phase 2.

o Partnership agreements will have to be made with healthcare partners for certain business functions (e.g., exchange of medical appointment data), and appropriate SLAs will be developed and agreed upon.

o Additional SLAs may have to be identified and developed as part of the development of SOPs for Health Connector.

o Also, once third-party contractors are determined, SLAs will have to be established for the provision of services through them.

1.5.2 Healthcare Providers

Constraints and changes to operational policies as applicable to healthcare providers are listed below:

- **Access to Health Connector:** As discussed earlier, HIRTA will have to provide an appropriate level of access to Health Connector system to authorized staff at healthcare providers for management of healthcare appointments and monitoring of transportation services for those appointments.

- **Access to appointment data:** Either using the currently established process for information release at healthcare providers or through new release authorization terms and conditions that healthcare providers are willing to adopt, healthcare providers will have to provide access to medical appointment data which will at least include 1) customer identifier; 2) customer/caregiver contact; 3) time of appointment; 4) day of appointment; 5) location of appointment; 4) doctor's office contact information. Required details, including a consent form regarding data release, will be finalized at the time of detailed design in Phase 2**.**

  HIRTA has been including healthcare providers as part of stakeholder engagement sessions (e.g., ConOps walkthrough, SyRS walkthrough), so they are aware of the data needed for coordinating medical and transportation appointments. HIRTA will continue to engage with healthcare partners throughout Phase 2 design for establishing the terms for informed consent form to be signed by the patients who will use Health Connector. Stakeholder input from healthcare providers is being documented in meeting minutes and any online meetings are recorded. Also, HIRTA team will closely follow the currently established terms used by the healthcare partners to share data with caregivers to avoid any deviations from the currently established practices.

- **Funding source definition and billing:** Most healthcare providers have mentioned that they have access to funds which can be used towards covering the transportation cost for persons with low income. HIRTA has the capability to define funding sources in its system, and healthcare providers can be listed as a funding source. For eligible trips, such funds will be used, and the healthcare providers will be billed per agreed upon terms and conditions. Accounting for such funding source will follow the same tools and established processes used by HIRTA for other funds in use today.

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- **Coordination on hours of operation:** When there is a change in healthcare provider service hours for non-emergency visits, Health Connector system will be updated and HIRTA will be notified.

- **Staffing:** HIRTA already coordinates with dedicated social worker and health navigator staff at healthcare providers. However, this process will have to be finalized, and enhanced communication access through Heath Connector solution will be made available to minimize any manual coordination.

- **Tracking transportation access and missed appointments:** Currently, there is limited capability in linking missed appointments with transportation access and subsequent impact due to lost patient opportunities. With access to Health Connector, healthcare providers should define appropriate and relevant KPIs and track and analyze data for measuring the KPIs. The HIRTA team is developing relationships with healthcare providers in Phase 2 and will assist with defining KPIs as needed.

1.5.3 DCHD

Constraints and changes to operational policies as applicable to DCHD are listed below:

- **Access to Health Connector:** As discussed earlier, HIRTA will have to provide appropriate level of access to DCHD to authorized staff for management of healthcare appointments and monitoring of transportation services for those appointments, as authorized by their customers.

- **Access to data and reporting as relevant to measuring health outcomes:** DCHD currently relies on data in their information and referral system for measuring the success of efforts in linking Dallas County residents with resources. Health Connector will provide the ability to track not just successful connections but will also allow follow-ups after appointments are complete and take any subsequent actions if necessary. However, polices for such additional efforts will have to be defined by DCHD as conversations between the HIRTA team and DCHD take place in Phase 2.

1.5.4 Travelers

Constraints and changes to operational policies that impact Travelers include:

- **Training and Application Access** The HIRTA team will have to ensure that Travelers can use the app effectively and are provided relevant training resources they may need for booking trips through the app. Training plans will be developed as part of Task 2-F. Travelers will also need to accept terms and conditions and user agreements that are related to application usage.

- **Call Center Availability:** Travelers will need to be made aware that they can contact the HIRTA call center should them have any issues using the Health Connector web app or mobile app. The HIRTA call center representatives will need to be prepared to provide guidance and assist with booking for Health Connector trips as needed.

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2 Stakeholders and Concerns

2.1 Introduction

This section describes the stakeholders and their concerns regarding the HIRTA Health Connector solution. Based on the ISO/IEC/IEEE 42010 standard, the stakeholders of a system have concerns about the system of interest in relation to its environment. As a concern is identified throughout the system life cycle, it could be held by one or multiple stakeholders.

2.2 Stakeholders

The following table represents the full list of stakeholders for the proposed Health Connector solution.

Table 1: Health Connector Stakeholders for Phase 2/3

Stakeholder Name	Stakeholder Description	Key Responsibilities
Access2Care	Iowa Medicaid Enterprise transportation broker.	Assists with Medicaid Traveler rides. Verifies eligibility for medicaid Travelers.
Aging Resources of Central Iowa	Stakeholders representing underserved groups and will help identify needs for the groups they are representing.	Interfaces with the system for measuring performance of the system in meeting health outcomes within their communities.
American Cancer Society	Stakeholders representing underserved groups and will help identify needs for the groups they are representing.	Interfaces with the system for measuring performance of the system in meeting health outcomes within their communities.
Arcadis IBI Group	Systems engineering lead and technical developer for the Health Connector concept.	Leads technology procurements and systems engineering and overseeing testing and deployment in Phase 2/3.
Broadlawns Clinic	Private hospital in Polk County with a local clinic in Dallas County. It is a primary clinic site involved in the deployment.	Active participation in stakeholder meetings.
Capture Management Solutions (CMS)	Marketing and Outreach Lead.	Leads all stakeholder outreach, product marketing, and showcase as defined in the Outreach Plan.
Central Iowa Rural Transportation and Planning Alliance / Metropolitan Planning Organization	Advisory group, provides assistance with passenger transportation planning and long-range transportation plans, interested in transportation for all populations.	Active participation in stakeholder meetings.

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City of Adel	Local government funding partner.	Works with HIRTA and to help identify broad community-based needs (e.g., social determinants of health) and will use the system to stay informed on project outcomes.
City of Perry	Local government funding partner.	Works with HIRTA and to help identify broad community-based needs (e.g., social determinants of health) and will use the system to stay informed on project outcomes.
City of Waukee	Local government funding partner.	Works with HIRTA and to help identify broad community-based needs (e.g., social determinants of health) and will use the system to stay informed on project outcomes.
Community Health Partners	Health care representatives who interact with HIRTA, DCHD and other community partners.	Aims to improve the experience for patients vising healthcare facilities.
Community Transportation Association of America (CTAA)	One of the lead project stakeholders for the Health Connector Concept.	Serves as deployment lead in Phase 2/3.
Dallas County Health Department (DCHD)	Dallas County Health Department is the primary hospital site involved in deployment of the Health Connector.	Assists with coordinating health facilities and health care workers to assist with Health Connector.
Dallas County Hospital	Local private hospital in Dallas County	Serves as a possible destination for Health Connector Travelers
Dallas County VA	Stakeholders representing underserved groups and will help identify needs for the groups they are representing.	Interfaces with the system for measuring performance of the system in meeting health outcomes within their communities.
DCHD Health Administrator	Dallas County Health Commissioner (or individuals in similar role) responsible for wellbeing of the community.	Measures performance and health outcomes.
DCHD Health Navigators	Employees of the Dallas County Health Department (DCHD).	Connects customers/patients with healthcare providers and HIRTA (or other transportation service providers) by providing information and referral services.
Disability Rights Iowa	Stakeholders representing underserved groups and will help identify needs for the groups they are representing.	Interfaces with the system for measuring performance of the system in meeting health outcomes within their communities.
FTA Region 7	Regional government partner.	Provides project oversight and regional assistance as needed.
Funding Entity	Organization funding customer trips (e.g., Medicaid)	Interfaces with the Health Connector system for automated billing and payment processing

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Healthcare Customer Care Staff	Healthcare staff who take calls and intake customer request for medical appointments. Customer care staff may do other coordination related to medical appointments as well.	Helps receive patients who arrive through Health Connector
Healthcare Operations Staff	Staff that is responsible for interacting with customer on check-in and check-out. (e.g., customer care, nursing, community health partnership)	May interact with HIRTA, DCHD and other community partners on behalf of patients related to their appointments.
Heart of Iowa	Stakeholders representing underserved groups and will help identify needs for the groups they are representing.	Interfaces with the system for measuring performance of the system in meeting health outcomes within their communities.
HIRTA	Heart of Iowa Regional Transit Authority is leading the deployment of the Health Connector concept	Provides transportation planning, project management, and vehicles and staff to achieve Health Connector goals.
HIRTA Administration	HIRTA office staff responsible for overseeing and evaluating the Health Connector concept.	Responsible for functions such as verification of trip data, cost allocation, third-party billing (e.g., to funding sources), accounting and reporting. Most of this process will not change but certain flows are planned to be automated (e.g., interface with Medicaid).
HIRTA Customer Service Staff	Call center or customer-facing employees for HIRTA.	Responds to travelers' requests for all aspects of their trip experience beyond trip booking/modifications.
HIRTA Driver	HIRTA vehicle operators or contractor employees.	Picks up and drops off customers for their requested trips.
HIRTA Transportation Operations Staff	HIRTA dispatchers and operational support staff.	Assigns trips to vehicles, monitors trips, coordinates with drivers in real-time (e.g., their ability to perform additional trips, assisting to find origin or destination locations, help resolve no-show or cancellation) and makes reassignments if necessary.
HIRTA Trip Scheduler	HIRTA staff in charge of Health Connector trip planning for Travelers.	Processes customer requests and schedules rides.
Iowa Department of Public Health	Government agency that aims to protect and improve the health of all Iowans.	Helps determine health outcomes due to provision of healthcare transportation service.
Iowa Department of Refugee Services	Stakeholders representing underserved groups and will help identify needs for the groups they are representing.	Interfaces with the system for measuring performance of the system in meeting health outcomes within their communities.
Iowa DOT	Advisory partner and provider of state match for federal funds.	Serves as an advisory and governmental partner.

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Iowa State University (ISU)	Performance Management Lead who will provide the principal investigator (PI) and research staff	Leads participant recruitment, surveys, and data analysis in Phase 2/3.
Mercy Medical	Secondary private hospital site involved in the deployment.	Helps receive patients who arrive through Health Connector.
MOD Vendor	Developer of platform solutions. 2-3 FTEs will be dedicated by the MOD provider to participate in design and other implementation activities, as HIRTA will procure both the MOD solution and implementation services.	Provides the transportation platform for registration, scheduling, dispatching, and administration of healthcare trips.
NaviLens	Wayfinding solutions partner	Provides navigation services to travelers through application interface(s) and physical wayfinding kiosks.
Patient	Individuals who may not be HIRTA customers but are looking to schedule transportation services for their medical appointments, referral appointments or follow-up appointments or other medical needs.	Books transportation and medical services through the Health Connector.
Referral Agent	Individuals employed by organizations that connect the public to the providers according to their service requests.	Provides services may be related to healthcare or transportation.
Third Party Service Provider	Refers to contractors that may work with HIRTA in the future to provide services when HIRTA does not have the capacity through its own fleet.	Provides rides, drivers, vehicles, and data surrounding trips and trip monitoring services to support HIRTA fleet.
Traveler	Individuals, who are HIRTA clients and are requesting transportation services for their medical appointments. These services may be performed using HIRTA-operated vehicles or through HIRTA contractors.	Books transportation and medical services through the Health Connector.
United Way of Central Iowa	Stakeholders representing underserved groups and will help identify needs for the groups they are representing.	Interfaces with the system for measuring performance of the system in meeting health outcomes within their communities.
Unity Point	Secondary private hospital site involved in the deployment.	Serves as a possible destination for Health Connector Travelers
USDOT	Federal organization leading the ITS4US effort	Oversees Health Connector design and implementation.
Waukee Christian Services	Stakeholders representing underserved groups and will help identify needs for the groups they are representing.	Interfaces with the system for measuring performance of the system in meeting health outcomes within their communities.

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2.2.1 User Profiles

Of all the stakeholders involved in Health Connector, certain groups are identified as 'users' as well. Table 2 below outlines specific user profiles and associated responsibilities within the Health Connector system.

Table 2. Health Connector User Profiles

Organization	User Group	Abbreviation	Short Description
DCHD	Health navigators	HNV	Refers to the employees of the Dallas County Health Department (DCHD) who connect customers/patients with healthcare providers and HIRTA (or other transportation service providers) by providing information and referral services.
DCHD	Health administrator	HAD	Dallas County Health Commissioner (or individuals in similar role) responsible for wellbeing of the community. Users of the system for measuring performance and health outcomes.
HIRTA	Trip scheduler	SCH	HIRTA staff who processes customer requests and schedules rides.
HIRTA	Transportation operations staff	OPS	HIRTA staff who assigns trips to vehicles, monitors trips, coordinates with drivers in real-time (e.g., their ability to perform additional trips, assisting to find origin or destination locations, help resolve no-show or cancellation) and makes reassignments if necessary. At times, this process may also be fully automated and performed by the dispatching algorithm (e.g., TNC that may be used as third-party provider for real-time trips include algorithm that does dynamic ride-matching with available driver pool without manual interaction).
HIRTA	Customer service staff	CSR	Refers to HIRTA customer service staff who responds to travelers' requests for all aspects of their trip experience beyond trip booking/modifications.
HIRTA	Driver	DRV	Refers to HIRTA or contractor employees who pick up and drop off customers for their requested trips. There are no major changes expected for drivers as part of this implementation, but relevant needs are documented.

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Organization	User Group	Abbreviation	Short Description
HIRTA	Administration	ADM	HIRTA staff responsible for administrative functions such as verification of trip data, cost allocation, third-party billing (e.g., to funding sources), accounting and reporting. Most of this process will not change but certain flows are planned to be automated (e.g., interface with Medicaid).
Contractor	Third-party service provider	CTR	Refers to contractors that may work with HIRTA in the future to provide services when HIRTA does not have the capacity through its own fleet.
Healthcare Partner	Healthcare customer care staff	HCR	Healthcare staff who take calls and intake customer request for medical appointments. Customer care staff may do other coordination related to medical appointments as well.
Healthcare Partner	Healthcare operations staff (e.g., customer care, nursing, community health partnership)	HOP	Staff that is responsible for interacting with customer on check-in and check-out. Also, includes staff that interacts with HIRTA, DCHD and other community partners on behalf of patients related to their appointments.
Healthcare Partner	Community health partner	CHP	Staff that interacts with HIRTA, DCHD and other community partners for improving experience for patients vising healthcare facilities.
Other	Traveler	TRV	Individuals, who are HIRTA clients and are requesting transportation services for their medical appointments. These services may be performed using HIRTA-operated vehicles or through HIRTA contractors.
Other	Patients	PTN	Individuals who may not be HIRTA customers but are looking for transportation services for their medical appointments, referral appointments or follow-up appointments or other medical needs.
Other	Referral agents	RFR	Individuals employed by organizations that connect the public to the providers according to their service requests. In this context services may be related to healthcare or transportation.

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Organization	User Group	Abbreviation	Short Description
Other	Funding entity	FND	Organizations funding customer trips (e.g., Medicaid) that will interface with the system for automated billing and payment processing. This includes Access2Care.
Other	Community partners	CPS	Stakeholders representing underserved groups and will help identify needs for the groups they are representing. They will interface with the system for measuring performance of the system in meeting health outcomes within their communities
Other	Government partner agencies	GPA	Refers to local and state Government entities that partner with HIRTA and will help identify broad community-based needs (e.g., social determinants of health) and will use the system to stay informed on project outcomes
Other	MOD system	MOD	Refers to the MOD platform and supporting vendor staff.
Other	Wayfinding system	WAY	Refers to the wayfinding system and supporting vendor staff.
Other	Iowa State University	ISU	Refers to Iowa State University's Institute for Transportation (InTrans) and supporting staff.
Other	USDOT	USDOT	Refers to the USDOT-managed public data portal.

2.2.2 Other Involved Personnel

The following personnel are also involved in the operations of the proposed system:

- USDOT independent evaluation (IE) contractor – Personnel involved in USDOT-sponsored impact evaluation.

- Third-party application developers – Application developers with interest in using data products created by the proposed system. This may include IBI Group, and other developers who would use the Health Connector middleware product to enhance further for their needs. Further information about middleware development and specific data needs related to middleware will be made available as the HIRTA team is able to meet with the MOD vendor to understand its APIs and meet with EHR and Access2Care representatives to understand how to leverage what is in the existing APIs for those systems.

- System vendors and integrators – Private sector system vendors and integrators involved in the development and operation of the proposed system.

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2.3 User Needs

As discussed in the Phase 1 Concept of Operations (ConOps) [3], underserved populations in Dallas County, Iowa often experience challenges accessing medical care due to a lack of transportation, including information and services. In fact, according to a 2014 National Leadership Academy for the Public's Health (NLAPH) survey of Dallas County residents, approximately 39% of respondents (out of a total of 144 Dallas County respondents) cited missing at least one healthcare appointment due to lack of available transportation options. Further, it is noteworthy that approximately 70% of total respondents relied on either HIRTA or family/friends for their transportation needs.
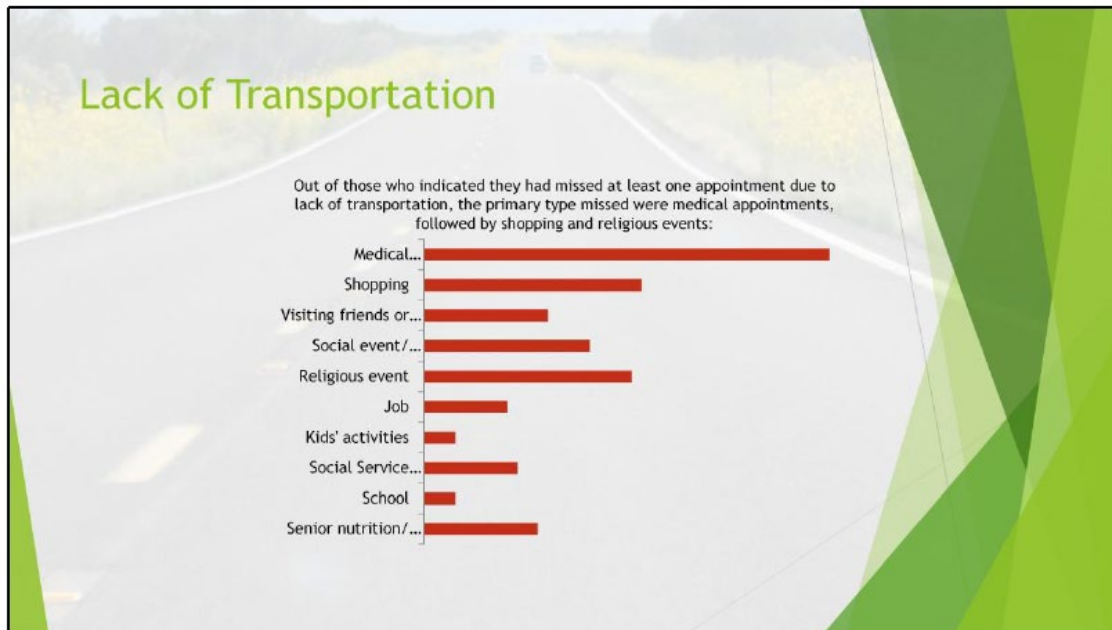
Figure 2. Excerpt of Survey Response from 2014 NLAPH Survey of Dallas County Residents (Source: DCHD)

Further challenges faced by Dallas County residents, and identified during stakeholder discussions, are discussed in detail in the ConOps report. Health Connector will utilize advanced technologies for planning, booking, service management, payment, information, and wayfinding to solve the challenges faced by underserved populations in Dallas County, Iowa for transportations services as needed for medical appointments.

Based on stakeholder discussions, a summary of the unmet needs, as originally discussed in the ConOps document [3], are as follows:

- **Lack of awareness about available transportation options:** One of the major factors limiting access to transportation is Travelers having limited information about options beyond personal (or arranged via family/friends) transportation for medical trips. Health Connector will provide a platform that will allow customers to explore availability of HIRTA and its partner vehicles through a "trip planning/discovery" feature within Health Connector.

- **Lack of integrated booking and trip management experience**: The planned Health Connector deployment concept addresses a longstanding need to integrate transportation

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and healthcare scheduling, management, and day-of services monitoring functions for the ultimate "one stop" experience for all Travelers for their mobility needs, with a specific focus on underserved populations. This solution will help Dallas County residents who are not able to make their medical appointments due to lack of access to transportation; they will be able to explore their options and book and manage a ride at the schedule of their choice.

- **Challenges in meeting the needs of underserved groups:** The key challenges relevant to transportation access to healthcare services in the context of HIRTA services are as follows:

  o Return trip is a major issue for all groups, since the end time for appointments cannot be accurately determined ahead of time. HIRTA tries to accommodate customers' requests for same day service, particularly for return trips, but due to limited driver/vehicle and financial resources, it is not possible to address the needs of all customers. Sometimes customers do not want to be on the same vehicle with others, which creates additional burden on resources and capacity to provide single ride transportation.

  o DCHD health navigators spend a lot of time and resources, often arranging multi-party calls, given the lack of access to consolidated information (funding eligibility, transportation availability, healthcare service availability) from a single tool. While most underserved groups are affected due to this limitation, persons with LEP need the most assistance and are severally impacted.

  o HIRTA currently offers services in limited hours, which does not meet the needs of many Travelers who may be interested in using HIRTA vehicles but are unable to use HIRTA to make their appointments. HIRTA has plans for providing services through third-party service providers for Travelers' after-hours needs.

  o Some people are not aware of HIRTA, or they do not take it because of the fee (e.g., $5.00 one way).

  o Most of the customers that Iowa Health and Human Services (HHS) works with are on Medicaid or Medicare. Also, the elderly groups are on Supplementary Security Income (SSI) and getting Medicaid, which covers some part of the transportation. However, Medicaid has very strict requirements as to what qualifies, and if a trip does not qualify for coverage, that could be a barrier that prevents the customer from making the trip. When customers are not eligible for Medicaid, HIRTA coordinates with funding partners and health navigators to determine if other funding sources are available for healthcare trips.

  o Older adults have identified lack of comfort with the use of smart devices as a major issue and have expressed a preference for devices with larger font specifically designed for older adults (e.g., Grand Pad). However, those devices have limited functions. Applications to be used by older adults must have the ability to adjust user experience by utilizing accessibility functions either available in the operating system or supplemented by built-in advanced capabilities within the application. Also, extensive training will be required so older adults are self-reliant in using the capabilities offered by the Health Connector solution. To increase usability for populations that are not tech-savvy, it will be most helpful to make the system design as simple as possible and with larger fonts. In addition, the team will continue to take

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into account user feedback as the app is rolled out to ensure the design is user-friendly and addresses the needs of all users.

o Persons with disabilities have limited mobility options when booking transportation, due to lack of accessible vehicles or those that can accommodate mobility needs such as walkers, oxygen tank, service animals, and others. All HIRTA vehicles are accessible but commercial vehicles (e.g., taxis or TNCs) provide a limited fleet of accessible vehicles.

o Third-party drivers need to understand how to assist persons with disabilities should they need assistance when using Health Connector. HIRTA should work with third-party providers to ensure they receive proper training and understand the needs of these individuals.

o Even at smaller facilities, wayfinding is an issue. Customers may have their first appointment on one side of facility and a second on another side, but they may not remember to share this information when booking a trip. Drivers typically must coordinate with dispatchers to find the out exact pick-up location.

o Customer experience during initial trips is critical. If a customer has a long wait or services were not available when needed for an appointment, customers are likely to prefer other transportation options. Most trips are on time, but when there are delays, the experience may prevent customers from trying the service again.

o The customer's ability to pay for trips is a major barrier. While HIRTA services are offered at a fixed low fare for customers that are covered by external funding sources, many low-income customers may still not be eligible for those services, due to the income criteria established by those programs (e.g., Medicaid). Also, low-income populations may rely on cash if they do not use banking and financial institutions.

o Persons with LEP may prefer to have someone accompany them for medical appointments so they can be helped. They may not use the tools and services available (e.g., translation service) as may not feel comfortable.

o Helping customers get where they need to create an additional cost to hospitals at times. While hospitals may have affiliated social workers and health navigators who help customers find transportation services, the process of registering and booking trips creates an administrative burden, due to a largely manual process. Also, healthcare providers have only limited funds available to help customers who may not have funds to pay for services arranged. One healthcare provider mentioned that coordination for follow-up care, coordinating the time and availability for the patients and the provider, educating the patient on their options, and communicating with the provider ends up being a time-consuming process for healthcare professionals.

o Healthcare customer coordinators currently rely on manual methods (e.g., phone calls, emails, in-person coordination, spreadsheets) to assist customers who may be looking for transportation services. They would prefer electronic capabilities as conceived within Health Connector, particularly real-time information on transportation services.

o Many customers live in rural areas where broadband access is lacking, unreliable, or insufficient. Also, the expense of data plans may limit the ability of low-income

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populations to use applications that may require extensive data bandwidth (e.g., feature-rich map interface).

- **Limited capabilities with current transportation modes**: Apart from HIRTA vehicles, there are limited modes that can meet the needs of underserved groups related to visual, hearing and learning disabilities, language barriers, and other limitations. The proposed project deployment will be universally designed to meet the needs of all Dallas County's underserved population, including persons with disabilities, low income, rural, older adults, veterans, and persons with limited English proficiency. As needs vary by the individual, underserved citizens may qualify for one or more these subgroups (i.e., the person may be an older adult who lives in a rural area, is a veteran, and has a disability).

- **Limited wayfinding capabilities:** Another missing link in medical transportation has been wayfinding both for locating the vehicle on arrival or wayfinding/navigating to the correct destination inside a facility upon arrival. The Health Connector solution will provide a seamless outdoor and indoor wayfinding experience from the same application.

- **Same day reservation and service capacity issues:** HIRTA typically does not provide same day reservations. Uncertainty with return trips may often generate a need for same day booking or modifications, creating capacity challenges in meeting customer demand. Health Connector will augment capacity through a seamless integration with taxi, TNC, and other non-dedicated service providers (NDSPs). Please note that these services are expensive and will have to be subsidized so the Traveler share is comparable to the use of other HIRTA services. HIRTA will be invoiced by NDSPs on a monthly basis for trips successfully performed.

- **Limited coordination among different organizations:** The proposed deployment seeks to further integrate the operations and services provided by HIRTA, DCHD, and the Dallas County healthcare community by providing them access to the transportation booking and real-time service information tools to maximize outcomes for the community and reduce the level of manual coordination by phone calls and emails. Access to these tools will also allow tracking of any missed medical appointments caused by lack of access to transportation.

- **Data sharing and reporting:** Currently, healthcare providers, DCHD, and HIRTA do not have any ability to share data or report on booking and delivery of medical trips. HIRTA has those trips captured within their transportation management system (TMS) provided by Via, but there is not enough data to analyze health outcomes of those trips. Health Connector will allow tracking of medical and transportation appointment related data (e.g., appointment date, time, and location by a customer identifier) by healthcare partners so DCHD, HIRTA, community partners, funding entities, and government partner agencies are able to monitor the impact of improved transportation access while protecting the privacy of individuals requesting trips. All data collection and sharing will be conducted per the approved process from the Institutional Review Board (IRB) at the Iowa State University (ISU) as documented in the Phase 1 and Phase 2 Data Management Plan [5] [7].

A detailed needs assessment is also provided in the ConOps document [3].

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2.4 Concerns

This subsection describes stakeholder concerns related to the Health Connector system. According to the ISO/IEC/IEEE 42010 Standard, concern means "any topic of interest pertaining to the system. The concerns are held by the stakeholders and govern the system architecture."

- **Developer's ability to meet specifications:** At this time, while HIRTA is in the process of selecting an MOD vendor, the details of the data exchange this vendor will be able to support with the Health Connector middleware are currently unknown. This information will be included in the final SAD.

- **Confidence from healthcare providers:** Several healthcare providers and partners are still concerned about the perceived benefits of this system in terms of reducing no-shows for medical appointments, as such a solution has not been widely deployed for public or partner use.

- **Partner Agreements:** HIRTA has received letters of support but will be finalizing agreements describing roles and responsibilities with healthcare partners during Phase 2. Exact terms and conditions are not currently determined, and this item is being tracked in the risk register.

- **Participant Recruitment and System Use:** HIRTA has developed a participant recruitment plan in Phase 1 but detailed outreach to actual travelers still needs to be conducted. Given the system will be deployed in a small rural area, it will be critical to ensure that the desired number of average daily trip volume can be met for calculating performance measures and achieving statistically significant results. This will be achieved through a combination of proactive outreach activities and a user-centered design for traveler-focused applications.

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3   System of Interest (SOI)

Figure 3 provides the Health Connector SOI context diagram with flows for each type of data, which includes the following major system and subsystems:

- **Traveler-end Subsystem**: includes the tools and technologies (phone/interactive voice response (IVR), mobile/smart devices, web-based tools) to be used by Travelers seeking transportation services for their healthcare appointments as part of their pre-trip, during trip, on arrival, and return trip activities. This includes both a mobility-on-demand (MOD) application for planning, booking, and payment, as well as a wayfinding application for more detailed guidance within care facilities.

  HIRTA is in the final stages of procuring a new, commercial, off-the-shelf (COTS) mobility-on-demand (MOD) application for planning, booking, and payment. This new application will provide real-time status of trips on demand and through push notification services and will allow Travelers to discover options and plans trips. Mobile/smart devices will be used as part of the traveler-end subsystem but are not a part of this procurement.

  In addition to being used by Travelers, the new MOD app will be made available to health navigators and healthcare providers, so they are able to book trips directly without involvement of HIRTA staff. It will also be fully integrated with the new Traveler and driver applications discussed below. Further, because the new MOD app will be required to publish public APIs, it will support using third-party service providers for adding capacity when needed in real time, and it will be able to interface with the Transportation Management System.

- **Transportation Management Subsystem (TMS):** includes the technologies used to assist customer care and operations staff with Traveler registration, eligibility management, reservations, scheduling, dispatching, billing, and administration activities. These products are commercially available from various providers of paratransit/demand response vendors.

  While a COTS MOD platform will be procured, the interfaces between the MOD platform and the State of Iowa Medicaid transportation broker(s), the EHR system, and the TMS need to be developed from scratch. These interfaces (middleware) will be developed by the HIRTA team and made freely, publicly available on GitHub under a permissive license. This middleware will be external to the MOD Platform TMS, but sits within the broader HIRTA TMS which includes functions that support health connector from outside of the MOD platform.

- **Vehicle Subsystem**: refers to the technologies deployed on vehicles to support driver-end functions for driver-dispatch communications, manifest management, support just-in-time dispatching, turn-by-turn navigation and outdoor wayfinding (e.g., to locate Travelers at the time of pick up), on-board information and fare payments. On all HIRTA-owned

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vehicles, drivers will use tablets running the driver app. On other vehicles, drivers may use the driver app on their tablet or their phone.

- **Wayfinding Subsystem:** refers to the technologies and infrastructure to be used for providing outdoor wayfinding, indoor positioning, orientation, and step-by-step guidance on request to travelers**.** One or more commercially available wayfinding system providers may be used.

- **External Systems:** These systems, external to Health Connector, have been identified for close coordination among HIRTA and partners for providing efficient transportation services for medical trips or for collecting data for performance measurement needs.

    o **Medicaid Transportation Broker**: refers to the State of Iowa Medicaid broker. Currently, Access2Care's system is used for booking and managing Medicaid trips. HIRTA is one of the providers used by Access2Care. Medicaid trips will continue to be booked by Access2Care when requested by Travelers. Medicaid trips will be ingested in the HIRTA system when assigned to HIRTA. At that point, a Traveler using Medicaid benefits will be able to use Health Connector Traveler tools.

    o **Health Navigator- and Healthcare-end Subsystem**: refers to the limited access MOD platform that will be available to health navigators and healthcare customer care staff to request trips, modify trip requests, and check on trip status on behalf of Travelers.Additionally, health navigators and the health administrator at the Dallas County Health Department (DCHD) use a Microsoft Access-based information and referral (I&R) product to track the status of referral activities and for coordination with Dallas County residents' health navigation/social care services.

    o **EHR/Medical Record Subsystem**: refers to the systems used by partner hospitals and clinics for booking medical appointments and maintaining their appointments, including discharge and any subsequent referral activities. Healthcare partners use different EHR services, including Epic EHR, which provides a publicly available API. Health Connector will develop a new interface with at least one of the healthcare partners' EHR systems.

- **Other**: Additional relevant details for the system to be deployed are as follows:

    o **Supporting systems**: These are existing systems and are not part of the Health Connector project. However, the TMS will exchange data with these systems or HIRTA staff may interact with these systems for certain operational functions, as needed. Specifically, this refers to driver or vehicle information management, vehicle maintenance management, customer service management, safety event reporting, and other systems and processes for data collection and reporting. HIRTA currently uses capabilities within the Via application for completing some such functions, but other off-the-shelf products are also commercially available.

    o **Data storage**: Traveler applications will store data locally as allowed by their devices and as authorized by Travelers. Vehicle and TMS subsystems will communicate over cellular data communication for operational data exchange. All

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data is exchanged in real-time (at a configurable frequency). Data is temporarily stored on the vehicle to support offline operations in the event of communication failures. On the central side, TMS data will be stored in a relational database in the AWS cloud storage. Data is stored in a live database to support real-time operations and then processed and archived for reporting in a historical database.

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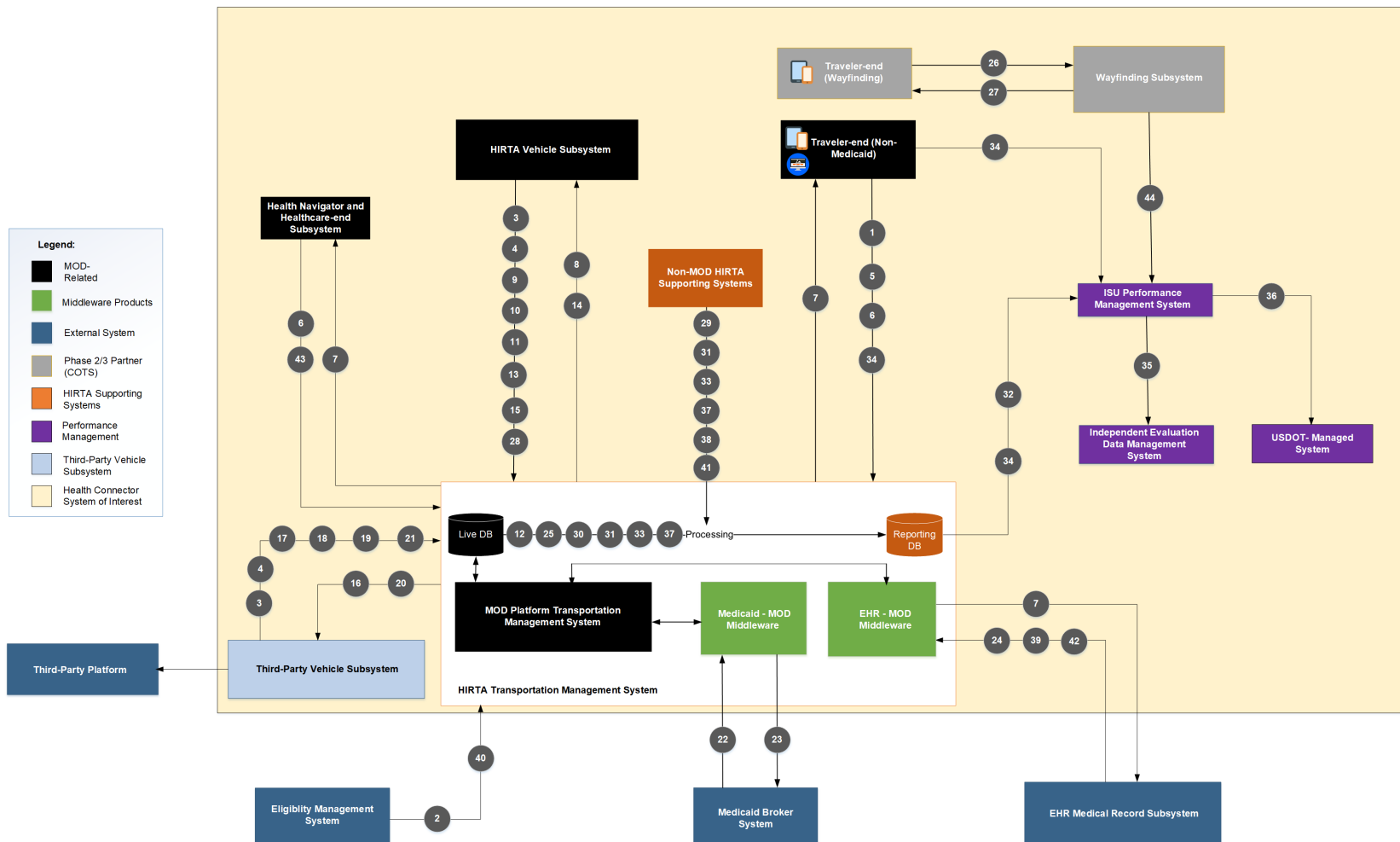
Figure 3. Health Connector System of Interest Diagram (Source: HIRTA team)

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The system of interest diagram outlines the data that will pass between systems as part of Health Connector. Keeping the replicability of Health Connector in mind, these datasets and terms used are common in paratransit/demand response industry and are applicable to most commercially available platforms/solutions. The labels referencing data flow IDs in Figure 3 refer to IDs described in Table 3 (please see the Phase 1 DMP [5] for further reference).

Table 3. Data Needs Summary

ID	Data	High-level Description	System(s) of Interest Involved
1	Traveler profile	Traveler's personal details as provided as part of registration.	MOD platform
2	Traveler eligibility	Traveler's eligibility for a funding source or program; also verified with funding entities (e.g., Medicaid).	Eligibility management system/funding source
3	Fleet information	Details on HIRTA's vehicles; also, details on third-party vehicles.	MOD platform; third-party platform
4	Driver information	Details on HIRTA's drivers; also, details on third-party vehicles.	MOD platform; third-party platform
5	Trip request	Traveler request for a trip from a web or mobile device; some Travelers may request over phone and use concierge/ customer care service.	MOD platform
6	Trip modification or cancellation	Traveler's request for modification to an existing trip, including cancellation.	MOD platform
7	Trip status	Current information on upcoming trip.	MOD platform
8	Manifest	Time and location details on Travelers to be picked up and dropped off by a driver during a shift.	MOD platform
9	Vehicle location	Location and heading along with other details for a vehicle in service.	MOD platform
10	Trip performance	Trip-level log of actual time and location for trips on the manifest along with any no-shows and cancellation events.	MOD platform
11	Driver performance	Driver-level log of operational performance on log on, on-time performance, manifests completed.	MOD platform
12	Travel time	Time needed to perform on-board component of a trip.	MOD platform
13	Driver messages	Log of messages sent by drivers to Dispatchers.	MOD platform
14	Dispatcher messages	Log of messages sent by Dispatchers to drivers.	MOD platform
15	Fare payment log	Log of amount paid for a trip and method of payment.	MOD platform
16	Request for third-party trips	Time and location details on Travelers to be picked up and dropped off by a third-party driver during a shift.	MOD platform

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ID	Data	High-level Description	System(s) of Interest Involved
17	Trip performance (third party)	Trip-level log of actual time and location for trips on the manifest along with any no-shows and cancellation events for trips delivered by a third-party provider.	Third-party platform
18	Vehicle location (third party)	Location and heading for a vehicle in service along with other details for a third-party provider.	Third-party platform
19	Driver messages (third party)	Log of messages sent by drivers to HIRTA dispatchers.	MOD platform
20	Dispatcher messages (third party)	Log of messages sent by HIRTA dispatchers to drivers.	MOD platform
21	Fare payment log (third party)	Log of amount paid for a trip and method of payment.	Third-party platform
22	Medicaid trip requests	HIRTA-accepted request for Medicaid-funded trips through Medicaid broker platform.	Medicaid broker system
23	Medicaid trip performance	Trip-level log of actual time and location for trips on the manifest along with any no-shows and cancellation events for trips delivered for Medicaid-funded trips.	MOD platform
24	Medical appointment details	Consists of medical appointment date, time, and location (facility address and doctor's office) for a particular Traveler.	EHR
25	Aggregated summary	Aggregated data on driver, vehicle, and trip performance.	MOD platform
26	Traveler wayfinding request	Requests initiated by Travelers to the wayfinding system.	Wayfinding subsystem
27	Traveler wayfinding guidance	Log of wayfinding information provided to Travelers.	Wayfinding subsystem
28	Safety event	Log of incidents and accidents by vehicle/driver/trip.	MOD platform
29	Safety event report	Detailed reports by a safety event (incident, accident) with response.	HIRTA supporting systems
30	Trip history playback	Replay of trip events performed along with location trail during a shift by a driver.	MOD platform
31	System performance	Log of system performance, including any failures.	MOD platform; HIRTA supporting systems
32	Anonymized and/or aggregated data for performance evaluation	Anonymized/aggregated Traveler, trip, and operations data (as described in Table 3. Scope and Availability of Private Data in the Data Privacy Plan [5]) to support Health Connector performance evaluation.	MOD platform

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ID	Data	High-level Description	System(s) of Interest Involved
33	Traveler complaints log	Log of Traveler complaints received and actions taken.	MOD platform; HIRTA supporting systems
34	Traveler survey results	Customer data and survey conducted by ISU (including through the MOD platform) of human use participants and control group.	MOD platform; local data system at ISU
35	Processed data for controlled sharing	Controlled-access data available to researchers and the Independent Evaluation team.	Local data system at ISU
36	Data for public access	Aggregated trip summary at Census tract and/or traffic analysis zone (TAZ) level as defined in DMP (or another unit as refined in Phase 2) will be provided. Other data such as fleet, vehicle, and safety event (incident/accident) will also be provided.	Local data system at ISU
37	Cost and revenue data	Cost and revenue data by trip, including actual cost, fare paid, funding source share.	MOD platform; HIRTA supporting systems
38	Wheelchair failure log	Summary of events referring to situations when wheelchair lift could not function at the time of pick-up or drop-off.	MOD platform; HIRTA supporting systems
39	Medical appointment status	Real-time status of progress on a medical appointment resulting in an impact on the pick-up time.	EHR
40	Discount coupon/credit	Discount coupons or credits applied by trip.	Eligibility management system/funding source
41	Call center log	HIRTA call center statistics available from phone systems or manual logs.	HIRTA supporting systems
42	Missed medical appointments linked to lack of transportation access	Anonymized missed appointments linked to transportation access.	EHR
43	Trip request (partners)	Trips requested by DCHD and healthcare providers using MOD platform. To be tracked separately to assess the benefit of such capability.	MOD platform
44	Traveler wayfinding rating data	Travel rating of wayfinding requests provided prior to pick up and after drop off.	Wayfinding subsystem

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4 Architectural Views

This section contains multiple architecture views as defined by ARC-IT; each view adheres to the standard conventions of an architecture viewpoint. This section describes the architectural viewpoints, views, and models important to the project using block diagrams. In detail, this section describes the following views:

1. **Enterprise Architecture View**, describing the relationships between organizations required to support the overall system architecture.

2. **Functional Architecture View**, describing abstract functional elements (processes) and their logical interactions (data flows) that satisfy the system requirements.

3. **Physical Architecture View of Systems and Interfaces**, describing the physical objects (systems and devices), their application objects, and the high-level interfaces between those physical objects. This is the most fundamental model of the architecture. Each block is a specific, tangible, physical entity in the system.

4. **Communications Architecture View**, describing the communications protocols between system objects.

Figure 4 provides an overview of above views and how they related to service packages that have been used to define the architecture flows in this document (see Section 4.2.2).
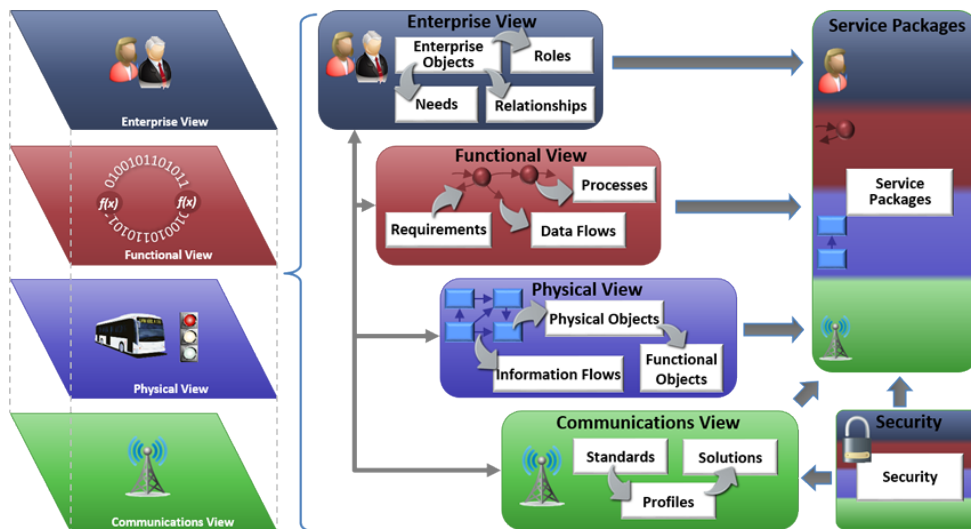
Figure 4. Architecture Overview (source: ARC-IT)

4.1 Enterprise View

The enterprise architecture view shows the relationship between organizations required to support the overall system architecture. The following subsections outline the project partners and the roles and resources they provide to the Health Connector effort.

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4.1.1 Project Stakeholders, Roles, and Resource Objects

For a full list of stakeholder descriptions, please refer to Section 2.2. Specific project partner roles and relevant resource objects can be found in the table below.

Table 4: Project Partner Roles and Resource Objects

Stakeholder Name	Role	Resource Objects
Access2Care	Verifies	Traveler Eligibility
Aging Resources of Central Iowa	Advises	HIRTA team
American Cancer Society	Advises	HIRTA team
Arcadis IBI Group	Manages	Systems engineering, middleware development
Broadlawns Clinic	Advises	Care Facility and Personnel
Capture Management Solutions (CMS)	Manages	Outreach
Central Iowa Rural Transportation and Planning Alliance / Metropolitan Planning Organization	Advises	HIRTA team
City of Adel	Advises	HIRTA team
City of Perry	Advises	HIRTA team
City of Waukee	Advises	HIRTA team
Community Health Partners	Advises	HIRTA team
Community Transportation Association of America (CTAA)	Manages	Deployment
Dallas County Health Department (DCHD)	Manages	Care Facilities
Dallas County Hospital	Operates	Care Facility and Personnel

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Dallas County VA	Advises	HIRTA team
DCHD Health Administrator	Operates	DCHD Personnel
DCHD Health Navigators	Advises	Travelers
Disability Rights Iowa	Advises	HIRTA team
FTA Region 7	Advises	HIRTA team
Funding Entity	Provides	Funding
Healthcare Customer Care Staff	Advises	Patients and Travelers
Healthcare Operations Staff	Operates	Care Facilities
Heart of Iowa	Advises	HIRTA team
HIRTA	Operates	HIRTA Vehicles, HIRTA Employees
HIRTA Administration	Operates	HIRTA TMS, MOD Platform
HIRTA Customer Service Staff	Operates	HIRTA Call Center
HIRTA Driver	Operates	HIRTA Vehicles
HIRTA Transportation Operations Staff	Operates	MOD Platform
HIRTA Trip Scheduler	Operates	MOD Platform
Iowa Department of Public Health	Advises	HIRTA team
Iowa Department of Refugee Services	Advises	HIRTA team
Iowa DOT	Advises	HIRTA team
Iowa State University (ISU)	Provides	IRB Approval, Survey Analysis
Mercy Medical	Operates	Care Facility and Personnel
MOD Vendor	Provides	MOD Platform
NaviLens	Operates	Wayfinding App, Wayfinding Equipment

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Patient	Uses	Personal Device
Third Party Service Provider	Operates	Third Party Vehicles, Third Party Employees
Traveler	Uses	Personal Device
United Way of Central Iowa	Advises	HIRTA team
Unity Point	Operates	Care Facility and Personnel
USDOT	Advises	HIRTA team
USDOT	Manages	ITS4US Projects, USDOT Data Hub

4.1.2 Relationships

Table 5 summarizes the relationships for the HIRTA Health Connector solution, including service agreements, expectations, and additional coordination types.

Table 5. Stakeholder Relationships

Primary Stakeholder	Stakeholder Group	Related Stakeholders	Coordination Type	Connector Type
HIRTA	Local partners	United Way of Central Iowa, Waukee Christian Services, American Cancer Society, Disability Rights Iowa, Iowa Department of Refugee Services, Aging Resources of Central Iowa, Dallas County VA, Heart of Iowa Community Services	Letters of support	Expectation
HIRTA	Government partners	City of Adel, Central Iowa RAP/MPO, City of Waukee, City of Perry	Letters of support	Expectation
HIRTA	Government partners	FTA Region 7, Dallas County Health Department, Iowa Department of Public Health	Advisory relationship	Expectation
HIRTA	Government partners	Iowa DOT	Contract	Agreement
HIRTA	Healthcare partners	MercyOne, UnityPoint, Broadlawns Clinic	Advisory Relationship, User Agreements (planned)	Expectation
HIRTA	Healthcare partners	Dallas County Hospital	Letters of support	Expectation

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Primary Stakeholder	Stakeholder Group	Related Stakeholders	Coordination Type	Connector Type
HIRTA	Healthcare partners	Access2Care	Agreement	Agreement
HIRTA	Technical services	Capture Management Solutions, Community Transportation Association of America, IBI Group, Iowa State University	Subcontracts	Agreement
HIRTA	Vendors	Arcadis IBI Group, Navilens, MOD vendor (Planned), third-party service provider (Planned)	Vendor support agreement	Agreement

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4.1.3 Relationships Diagram

Figure 5 shows the Health Connector's Enterprise View diagram, which illustrates the relationships between all project stakeholders.
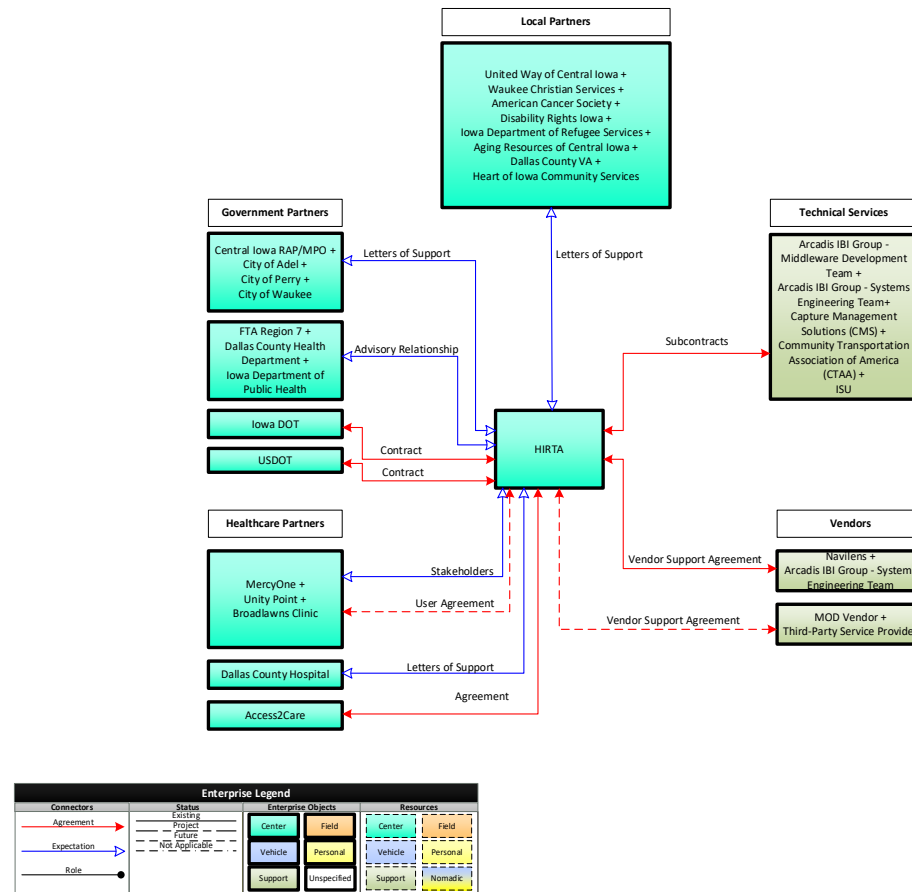
Figure 5. Health Connector Enterprise View Relationships Diagram (Source: HIRTA team)

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4.2 Physical View

The physical view represents the block diagram of the systems and interfaces in the HIRTA Health Connector system. This view illustrates the result of design decisions made by the HIRTA team for implementing the Health Connector systems and its subsystems. Furthermore, these figures present the physical architecture that is used by the project team to establish plans for system integration and testing, as well as to track and report readiness for deployment. The next subsections describe each entity in the figure and the logical connections between them.

4.2.1 Physical View for All Applications

Figures 6 – 21 of this report were developed using the SET-IT tool provided by the USDOT. The USDOT describes SET-IT as a "software tool that integrates drawing and database tools so that users can develop project architectures for pilots, test beds and early deployments."

The Level 0 diagram shows the Health Connector concept at its highest level. It shows how each physical object from across the system interacts with other physical objects and is intended to give a broad overview of all relevant elements. The Level 1 diagram provides a similar overview of the entire system, but also includes all functional objects that are within each physical object. Table 5 describes the broad types of information being exchanged between these objects as shown in the layer 0 and layer 1 diagrams.

Table 6. General Information Flows Between Physical Objects

Source Element	Destination Element	Information Flows
Health Navigator Subsystem	HIRTA Transportation Management System	Request trips, coordinate traveler information
HIRTA Call Center	HIRTA Transportation Management System	Confirm trips, coordinate dispatching
MOD Platform TMS	HIRTA Transportation Management System	Share health connector information with broader TMS
MOD Platform TMS	HIRTA Vehicle OBE	Send trip plans, route information, traveler information
MOD Platform TMS	Kiosk CMS	Send trip status
MOD Platform TMS	MOD App	Enable trip planning and booking, send trip itineraries
MOD Platform TMS	MOD-Medicaid Middleware	Send trip details for translation
MOD Platform TMS	Third Party Vehicle OBE	Send trip plans, route information, traveler information
HIRTA Transportation Management System	MOD Platform TMS	Share operational data
HIRTA Vehicle	HIRTA Vehicle OBE	Share status of vehicles
HIRTA Vehicle OBE	MOD Platform TMS	Confirm trips, send driver communication
Medicaid Broker	MOD-Medicaid Middleware	Request trips for Medicaid rides
MOD App	MOD Platform TMS	Request trips, set-up user accounts

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Source Element	Destination Element	Information Flows
MOD-Medicaid Middleware	MOD Platform TMS	Provide requested trips from Medicaid broker translated for MOD platform use
MOD-Medicaid Middleware	Medicaid Broker	Provide translated trip confirmation and trip booking information
Performance Measurement Team	USDOT Data Hub	Share cleaned performance data for public consumption
Remote Offices	VPN	Send secure center operator data
Third Party Vehicle OBE	MOD Platform TMS	Confirm trips, send driver communication
Third-Party Vehicle	Third Party Vehicle OBE	Share status of vehicles
USDOT Data Hub	Performance Measurement Team	Send data receipt confirmation, request specific performance data
USDOT Data Hub	USDOT Reporting Systems	Send government reporting systems data
USDOT Reporting Systems	USDOT Data Hub	Send government reporting data receipt
VPN	Remote Offices	Share secure center operator input
Wayfinding App	Wayfinding Server	Share traveler input
Wayfinding Server	Wayfinding App	Send data related to traveler interface updates
Cybox (ISU)	ISU Public Dashboard	Share public data related to KPIs
Electronic Health Record Subsystem	EHR Web Application	Create, modify, or cancel medical appointments
Electronic Health Record Subsystem	MOD-EHR Middleware	Create, modify, or cancel medical appointments
Eligibility Management System	MOD Platform TMS	Relay criteria related to Traveler eligibility
MOD Platform TMS	MOD-EHR Middleware	Create, change, or modify trip booking and status
MOD Platform TMS	Performance Measurement Team	Send raw data for evaluation
MOD-EHR Middleware	MOD Platform TMS	Provide translated medical appointment information
MOD-EHR Middleware	Electronic Health Record Subsystem	Provide translated trip confirmation and trip booking information
Performance Measurement Team	Cybox (ISU)	Manage raw data storage and archive analyses
Performance Measurement Team	MOD Platform TMS	Confirm data requests and provide data analysis
Wayfinding Kiosk	Kiosk CMS	Send traveler input and requests for wayfinding guidance

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Figure 6. Level 0 Diagram(Source: HIRTA team)

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Figure 7. Level 1 Diagram (Source: HIRTA team)

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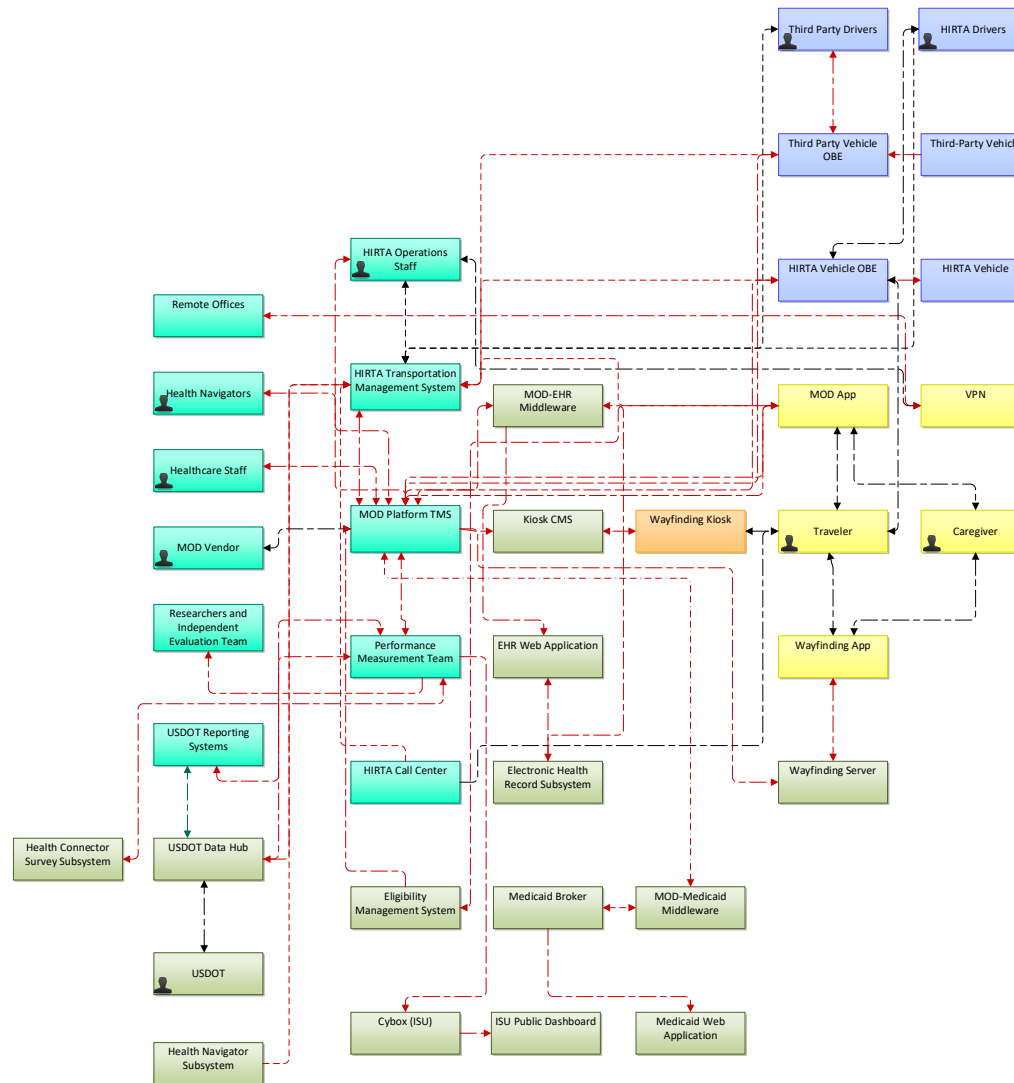Intelligent Transportation System Joint Program Office

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4.2.2 Service Package Diagrams

Service package diagrams are presented to show more specific information flows and relationships between physical and functional objects in context. Service packages may support more than one use case. While ARC-IT provides template service packages for many services provided in this project, these packages have been tailored to the specific elements and needs of the Health Connector system.

A list of all elements included in the Health Connector architecture can be found below.

Table 7. Health Connector Elements

Name	Description
Caregiver	Individual aides to Travelers that may assist with Health Connector use at a Traveler's request. Caregivers are provided access as determined by the Traveler.
Cybox (ISU)	Raw data storage center for performance data. Controlled and operated by ISU.
Electronic Health Record Subsystem	This subsystem refers to the systems used by partner hospitals and clinics for booking medical appointments and maintaining their appointments, including discharge and any subsequent referral activities. Health Connector will develop a new interface with at least one of the healthcare partners EHR.
Eligibility Management System	List that regulates who is eligible for Health Connector rides.
Medicaid Broker	Refers to the State of Iowa Medicaid Broker's system used for booking and managing Medicaid trips. Access2Care is currently the Medicaid broker, but this may expand to include others in the future. Medicaid trips will be booked by the broker when requested by Travelers and will be ingested in the HIRTA system when assigned to HIRTA. At that point, Traveler using Medicaid benefits will be able to use Traveler tools provided by Health Connector.
MOD App	Traveler application that allows booking on MOD platform, handles traveler information, service requests, trip feedback, and user account settings.
MOD-EHR Middleware	This open-source middleware product allows data exchange between the MOD platform and the EHR system.
MOD-Medicaid Middleware	This open-source middleware product allows data exchange between the MOD platform and the Medicaid broker system.

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Name	Description
Health Connector Survey Subsystem	Relates to surveys and data analysis related to project KPIs. This is led by the performance management team.
Health Navigator Subsystem	Used by Health Navigators to assist Travelers with care visits. Health navigators can assist with return trips as well as monitor traveler trips to appointments.
Health Navigators	DCHD employees responsible for assisting travelers with booking return trips as necessary.
HIRTA Call Center	Center for customer service related to Health Connector, including scheduling rides.
Healthcare Staff	Care facility employees responsible for assisting travelers with booking return trips as necessary.
HIRTA Drivers	Vehicle Operators for HIRTA owned and operated vehicles.
HIRTA Operations Staff	Responsible for operations related to Health Connector, including scheduling rides and blocking drivers.
HIRTA Transportation Management System	Software that is tailored to the planning, execution, and optimization of transportation process. This system collects trip data and helps evaluate system performance. This system will include both the MOD platform as well as the Health Connector middleware.
HIRTA Vehicle	Any health connector vehicle carrying Travelers that is directly managed by HIRTA.
HIRTA Vehicle OBE	On-board equipment on HIRTA managed health connector vehicles.
ISU Public Dashboard	Public-facing website displaying performance analysis results and visualizations related to project KPIs.
Map Database	Database of locational information and maps in service area.
MOD Platform	Mobility on demand platform, which includes the set of tools that allows travelers to book on-demand trips and operators to assign drivers and vehicles in real time.
MOD Vendor	Developer of platform solutions. 2-3 FTEs will be dedicated by the MOD provider to participate in design and other implementation activities, as HIRTA will procure both the MOD solution and implementation services.

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Name	Description
Remote Offices	Refers to any facilities other than a HIRTA center which employees may be working from (e.g., home office).
Researchers and Independent Evaluation Team	Other private researchers and the independent evaluation team that may request data from the HIRTA team. Data provided to this group will be controlled access.
Performance Measurement Team	Data center which stores information sent from the TMS and used only for external independent evaluation. For this project, ISU is serving as the performance measurement team.
Third-Party Drivers	Operate third-party vehicles that participate in Health Connector Trips
Third-Party Vehicle OBE	On-board equipment on HIRTA managed health connector vehicles.
Third-Party Vehicle	Any health connector vehicle carrying Travelers that is not directly managed by HIRTA (e.g., Uber or Lyft)
Traveler	Individuals, who are HIRTA clients and are requesting transportation services for their medical appointments. These services may be performed using HIRTA-operated vehicles or through HIRTA contractors.
USDOT	Federal organization leading the ITS4US effort.
USDOT Data Hub	External data center which stores data sent from HIRTA TMS to USDOT; will be accessible by the general public.
USDOT Reporting Systems	Refers to the network and structure to which HIRTA shall use for government data reporting; includes USDOT data hub
VPN	Virtual Private Network. Entails a network that provides online privacy by creating an encrypted connection to the internet when using public networks. VPN provides protected network connection by hiding IP address by letting the network redirect the connection through a configured remote server run by a VPN host.
Wayfinding App	Application that assists in orientation, location of objects, and step-by-step navigation to destinations, including navigation to and from pick-up location, healthcare facility, and drop- off location. Accessible via QR code.

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Name	Description
Wayfinding CMS	Content Management Software that communicates with wayfinding kiosks to provide information. Receives trip status information from the MOD platform.
Wayfinding Kiosk	Refers to any hardware used for wayfinding capabilities, including technology and infrastructure to be used for outdoor wayfinding, indoor positions, orientation, and navigation to travelers.
Wayfinding Server	Cloud-based server that handles traveler wayfinding requests and traveler wayfinding guidance via mobile app.

Service packages included in this document appear in order of their relevance to the Health Connector project.

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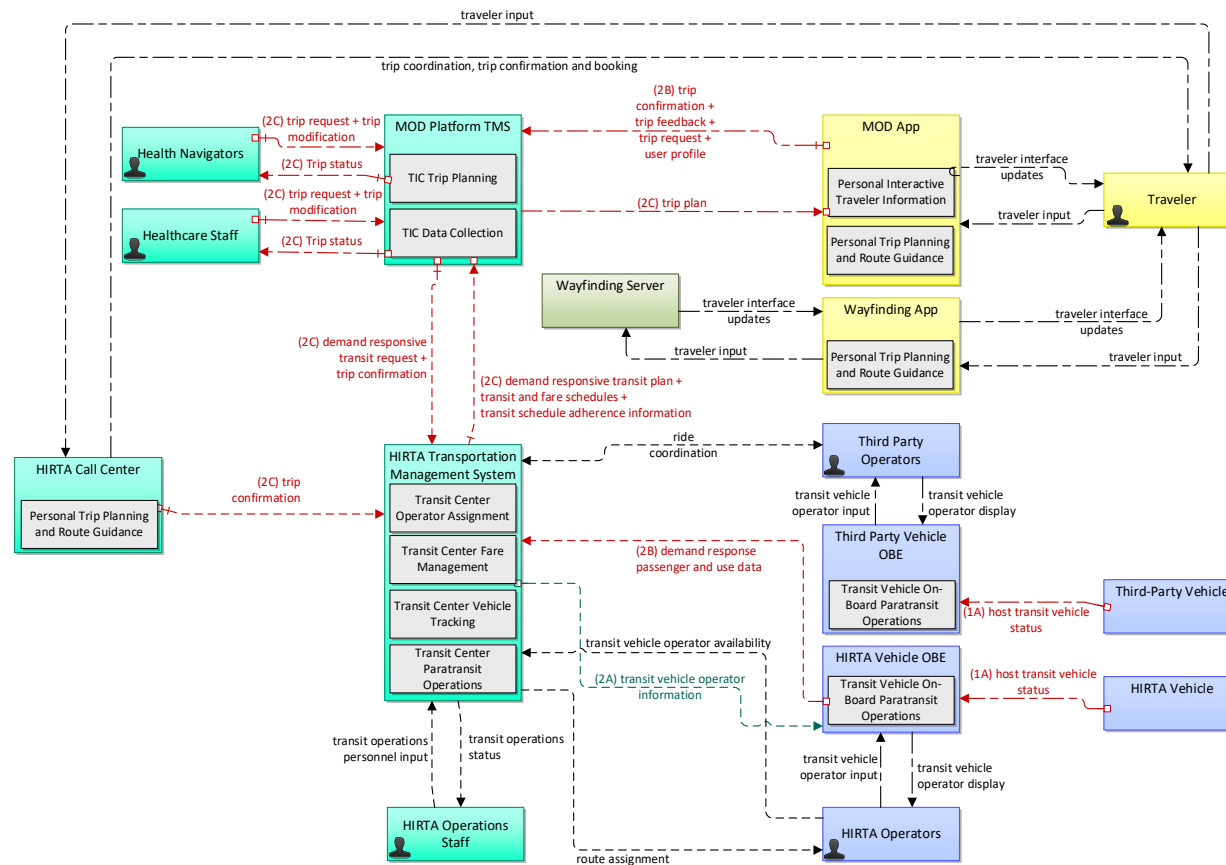
Figure 8. PT03 Dynamic Transit Operations(Source:HIRTA team)

This service package allows travelers to request trips and obtain itineraries using a personal device such as a smart phone, tablet, or personal computer. This serves as the core service package for Health Connector, showing ride requests from the Health Connector app, interaction with the MOD platform, and coordination between those elements and the HIRTA TMS, as well as communication between the HIRTA TMS and operating vehicles. Critical data flows in this diagram include trip planning between Travelers and the MOD app, and demand responsive transit planning.

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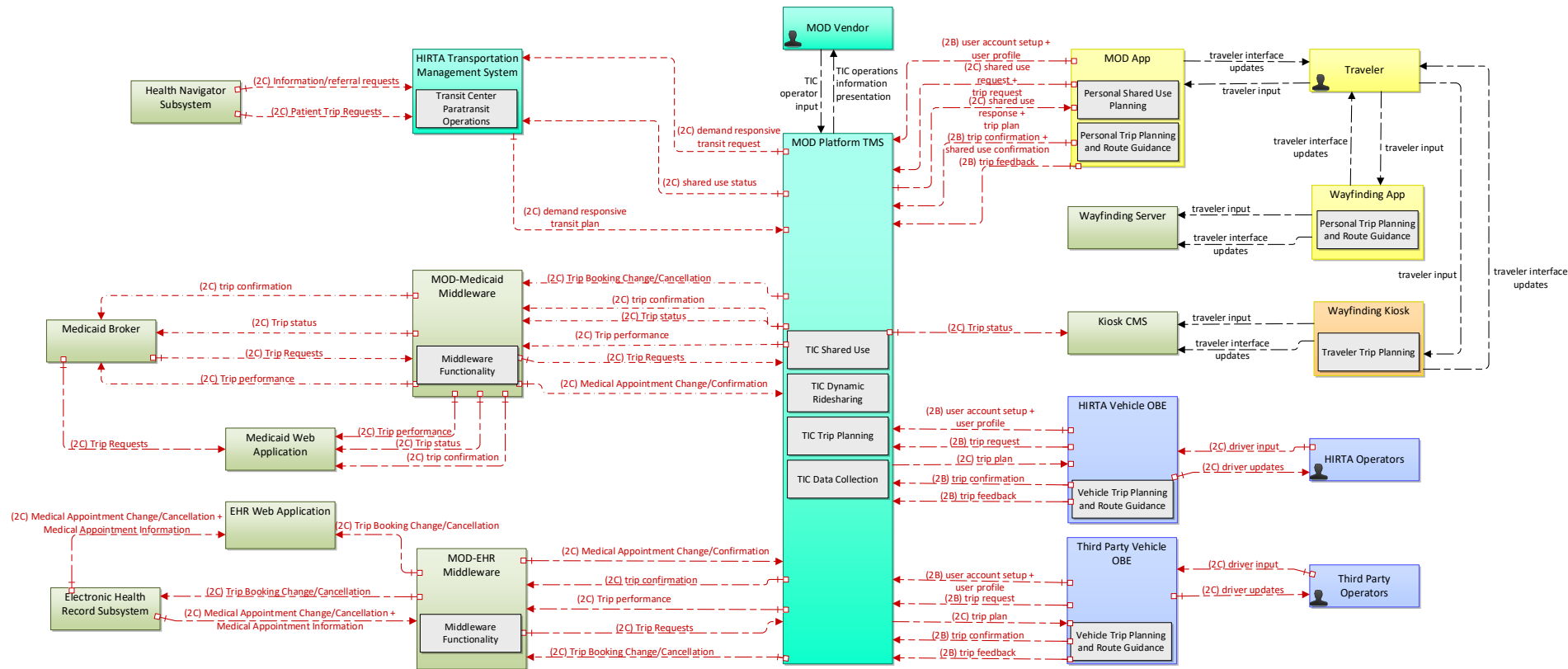
Figure 9. TI06: Dynamic Ridesharing and Shared Use Transportation (Source: HIRTA team)

This package addresses dynamic ridesharing services to travelers and other forms of shared use transportation. Health Connector Travelers can arrange on-demand trips through a personal device with a wireless connection to a ride matching system, which is handled through the MOD platform. These interactions are critical for determining Traveler eligibility and coordinating medical appointments during the ridesharing process. This service package is the primary physical view for interactions with health-related support systems and includes critical flows showing the interaction between those systems and the middleware and MOD platform. Some of the most crucial information flows in this diagram include trip requests, trip planning, trip confirmation, and trip feedback.

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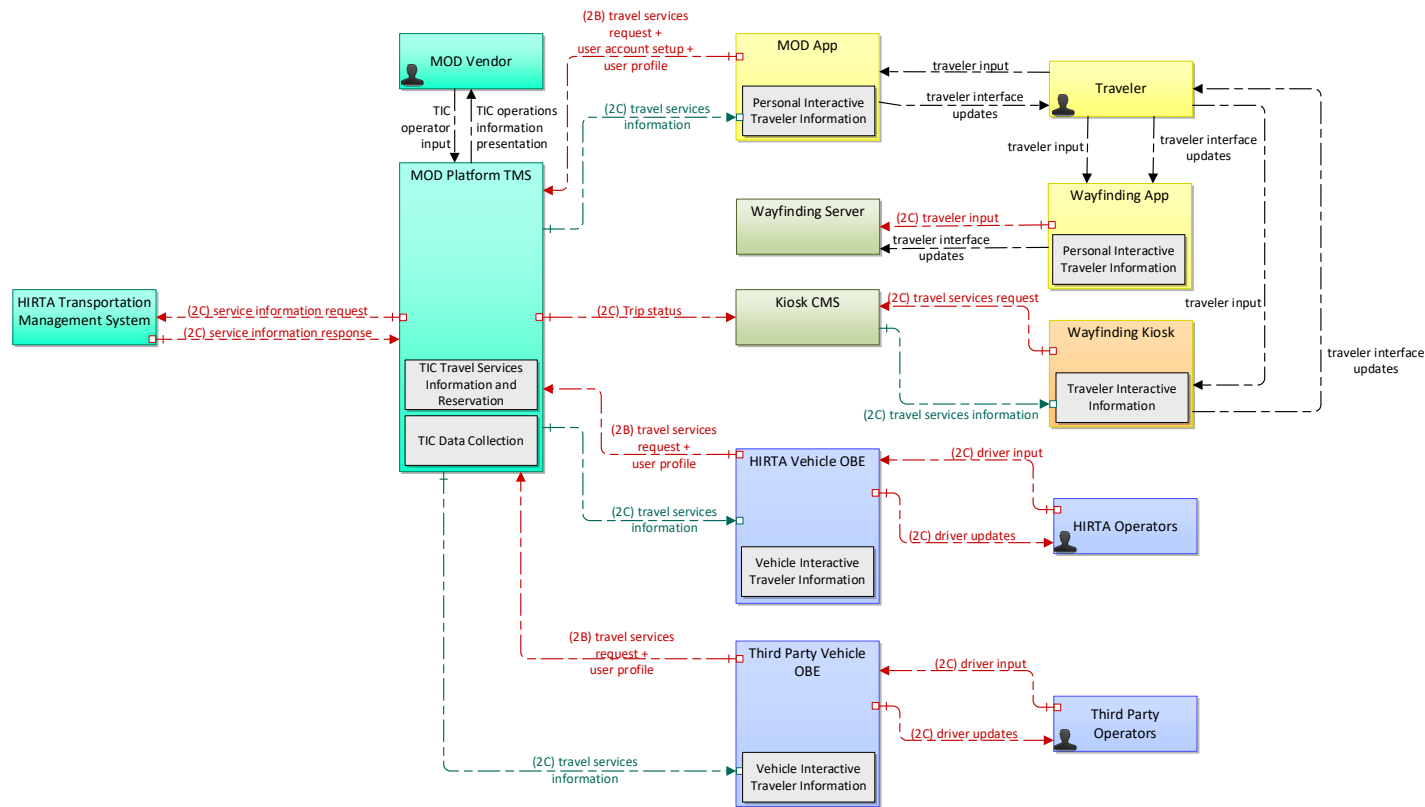
Figure 10. TI05: Travel Services Information and Reservation(Source: HIRTA team)

This service package provides travel service information and reservation services to the traveler pre-trip and while en-route. Within this project's context, it shows how information is provided to and from Travelers both through personal devices and wayfinding equipment, as well as to/from HIRTA vehicles and third-party operators. Travelers receive information about their driver, their route, and their destination as well as details regarding their appointment through the MOD app. Any care facility wayfinding can be done through interactions with the wayfinding kiosk; wayfinding external to care facilities is performed by the wayfinding app.

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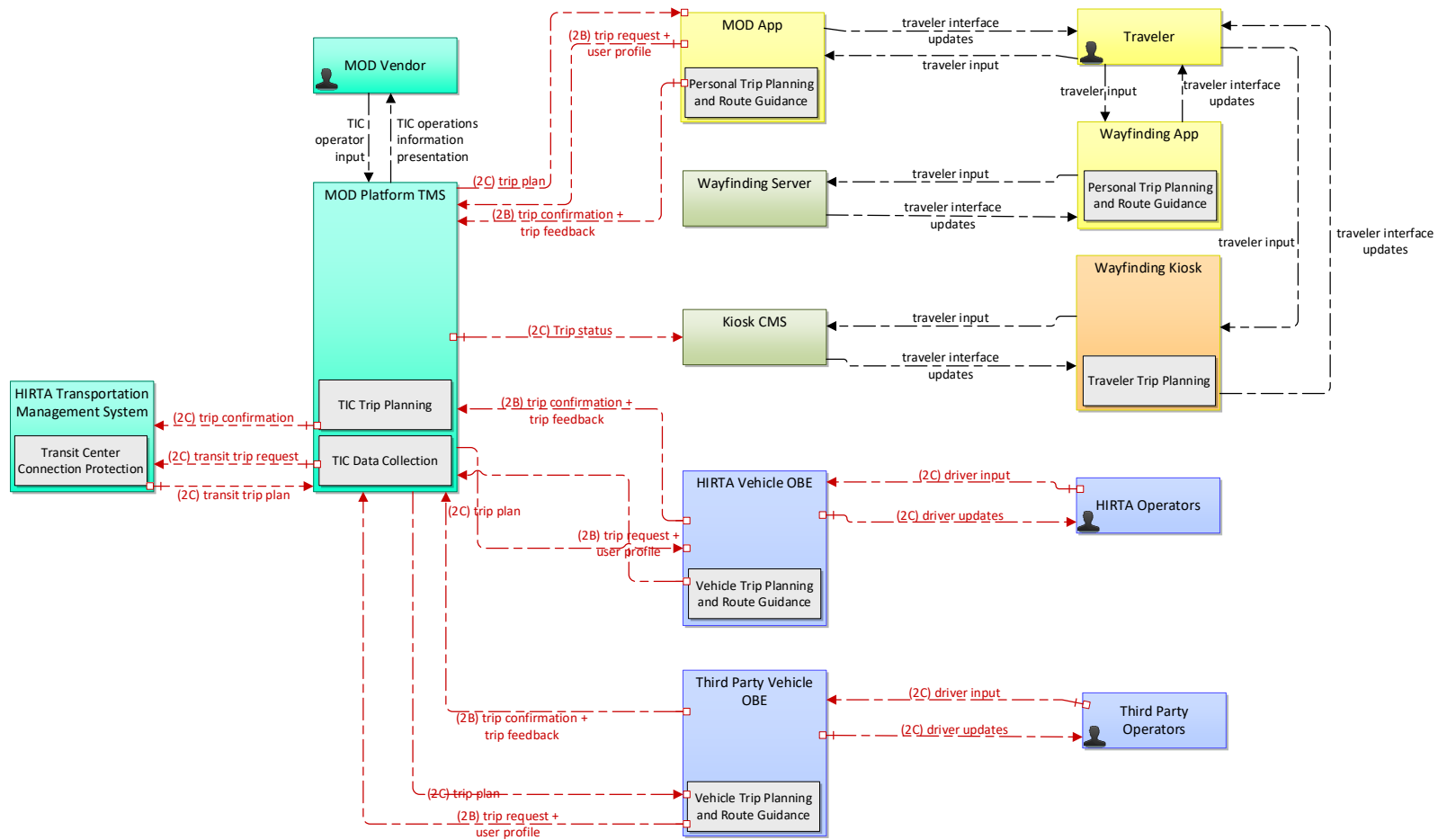
Figure 11. TI04: Infrastructure-Provided Trip Planning and Route Guidance (Source: HIRTA team)

TI04 shows the generation of a trip plan and associated service information, based on Traveler preferences and constraints. Unlike TI03, where the personal device determines the route, the route determination functions are performed by the center in this service package. In this case, the HIRTA TMS is assigning the route rather than using Traveler devices. This shows how the MOD platform can be used to dynamically assign rides and create optimal trip plans for HIRTA dispatchers.

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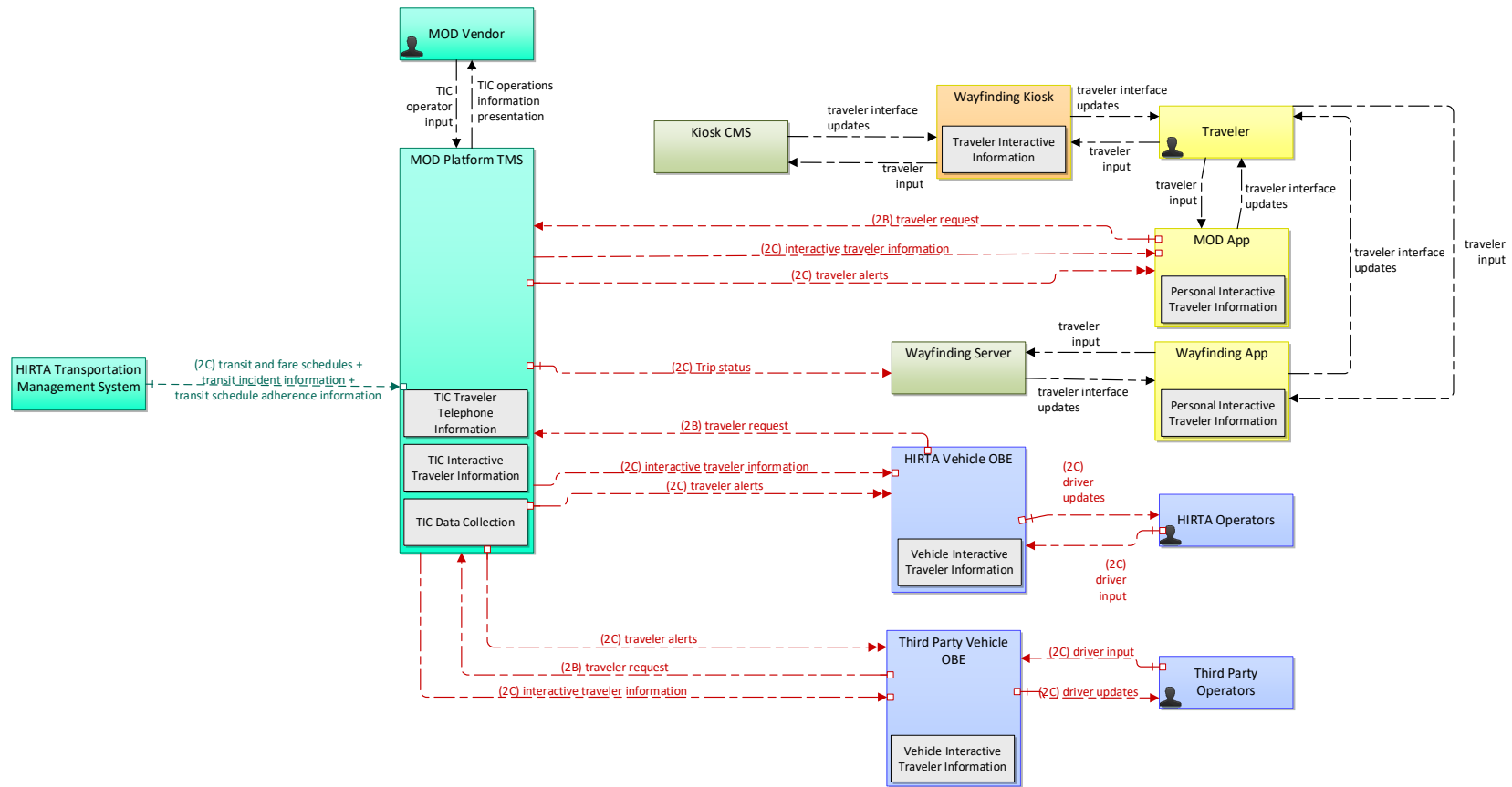
Figure 12. TI02: Personalized Traveler Information (Source: HIRTA team)

This service package provides tailored information in response to a Traveler request. Both real-time interactive request/response systems and information systems that "push" a tailored stream of information to the Traveler based on a submitted profile are supported. Travelers using the Health Connector app can receive tailored information on vehicle ETAs, routes, pricing information, and reservation details by interacting with the platform. Travelers can also interact with wayfinding kiosks via a QR code that they can scan with their personal device.

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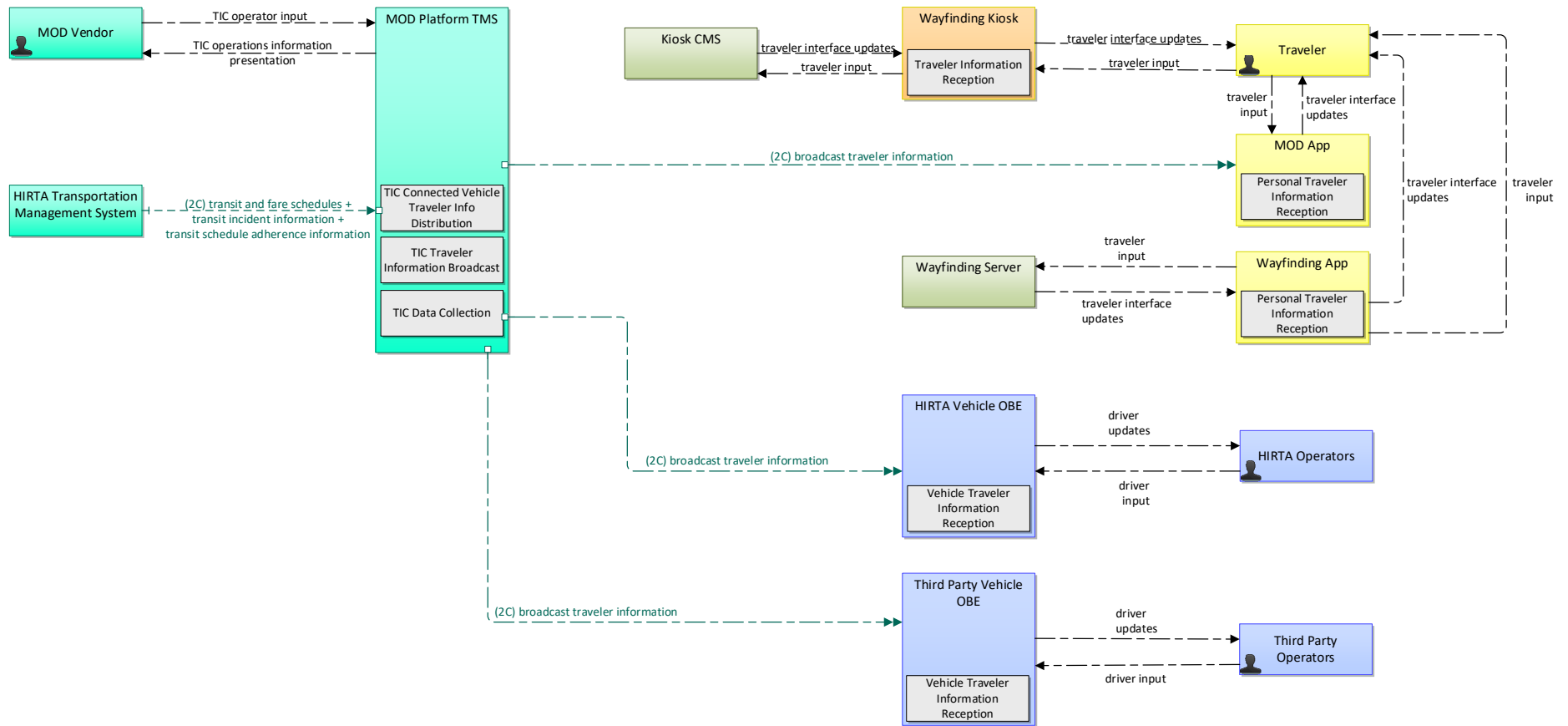
Figure 13. TI01: Broadcast Traveler Information (Source: HIRTA team)

This service package provides a digital broadcast service that disseminates traveler information to all equipped Travelers within range. This diagram shows how broadcast data is sent from the MOD platform and TMS, and received by vehicles in the form of infotainment. Travelers could also receive data through wayfinding kiosks and/or the wayfinding app in this scenario.

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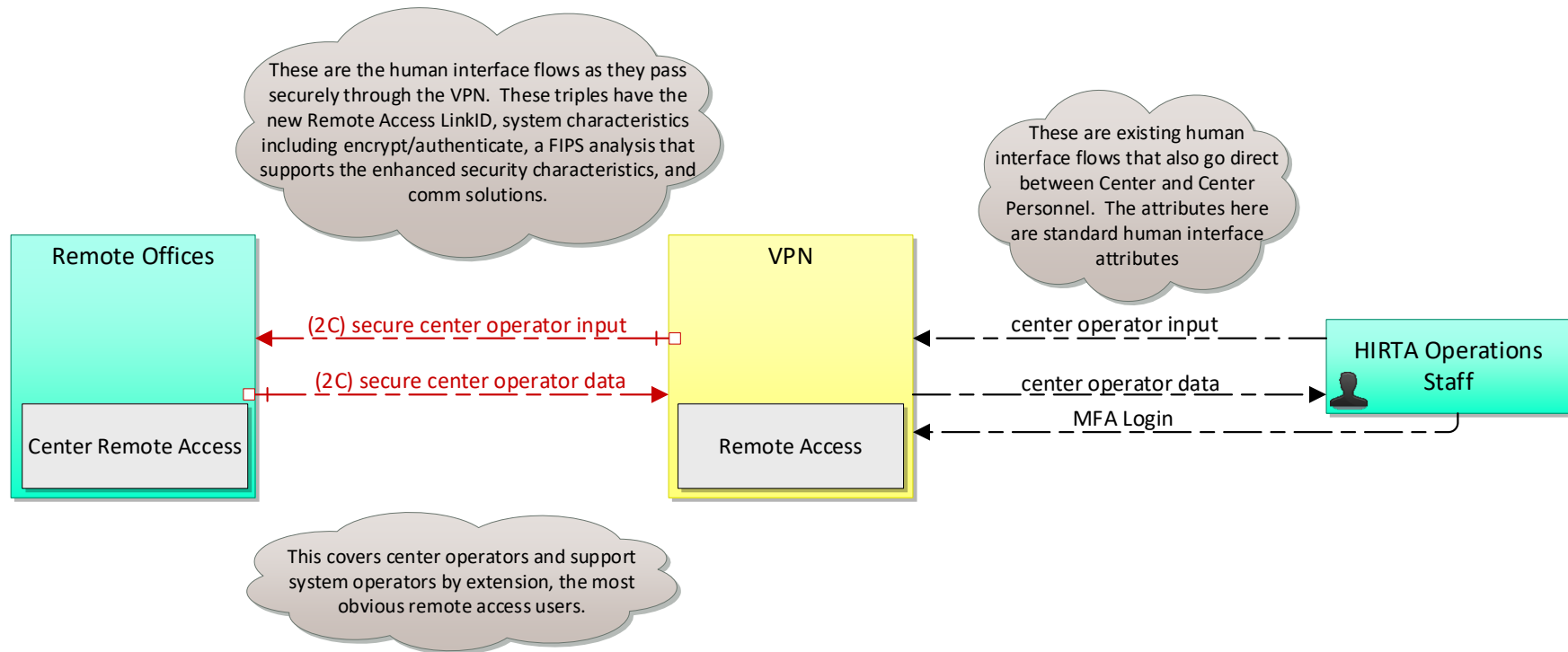
Figure 14. SU14: Remote Access (Source: HIRTA team)

This package shows how system operators, in this case HIRTA employees, can access user interfaces like HIRTA TMS remotely to provide support and enable Health Connector trips. HIRTA employees that are offsite in remote offices can use the VPN to access the work network and use these tools. Access to the VPN is permitted via MFA login.

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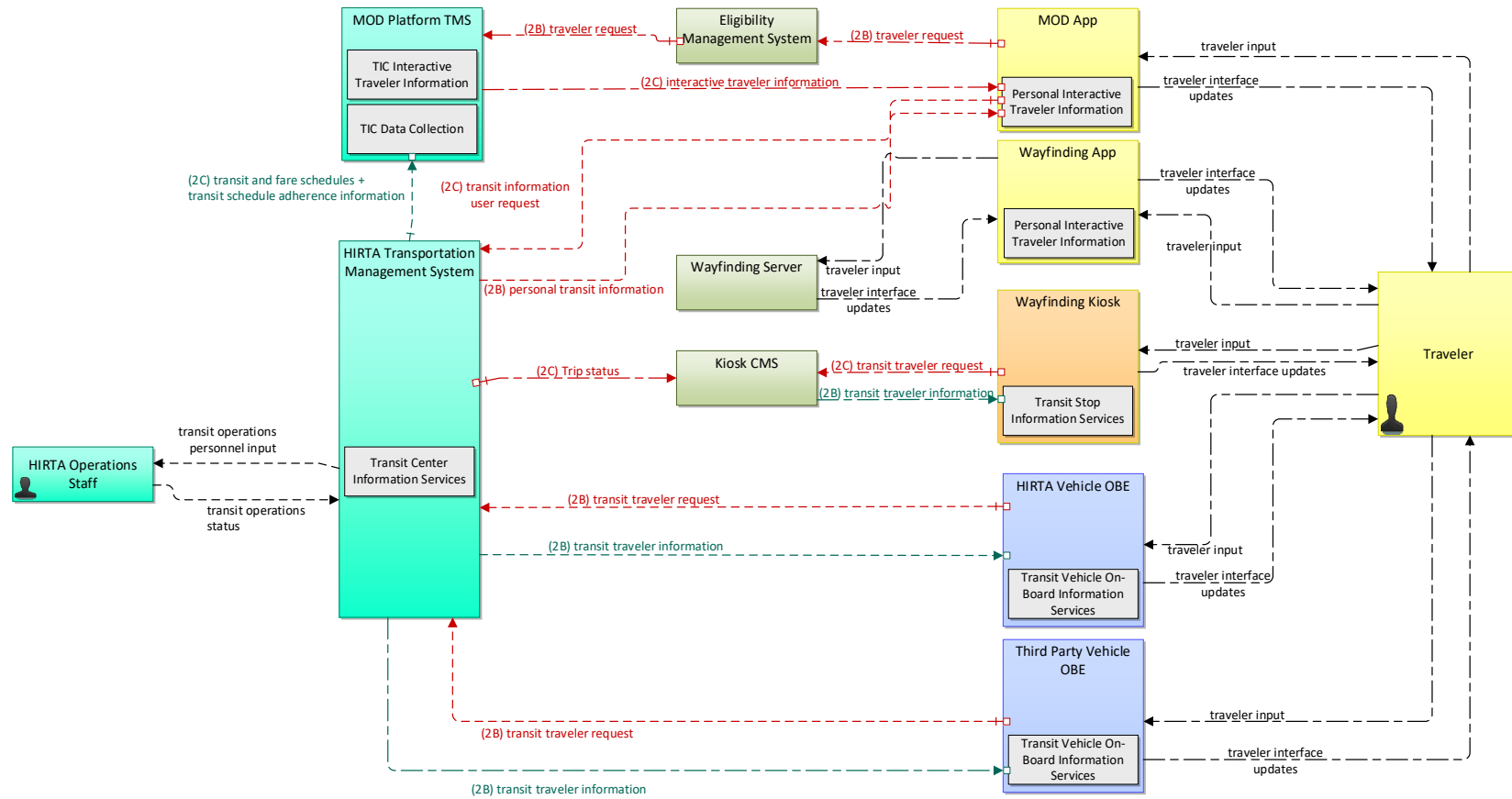
Figure 15. PT08: Transit Traveler Information (Source: HIRTA team)

This service package provides transit users at transit stops and on-board transit vehicles with ready access to transit information. The information services include transit stop annunciation, imminent arrival signs, and real-time transit schedule displays that are of general interest to transit users. For Health Connector, this relates to in-vehicle signage on HIRTA vehicles, as well as navigation provided via the wayfinding app and wayfinding kiosks. Critical information flows represented in this diagram include transit information requests, transit traveler information, and interactive traveler information.

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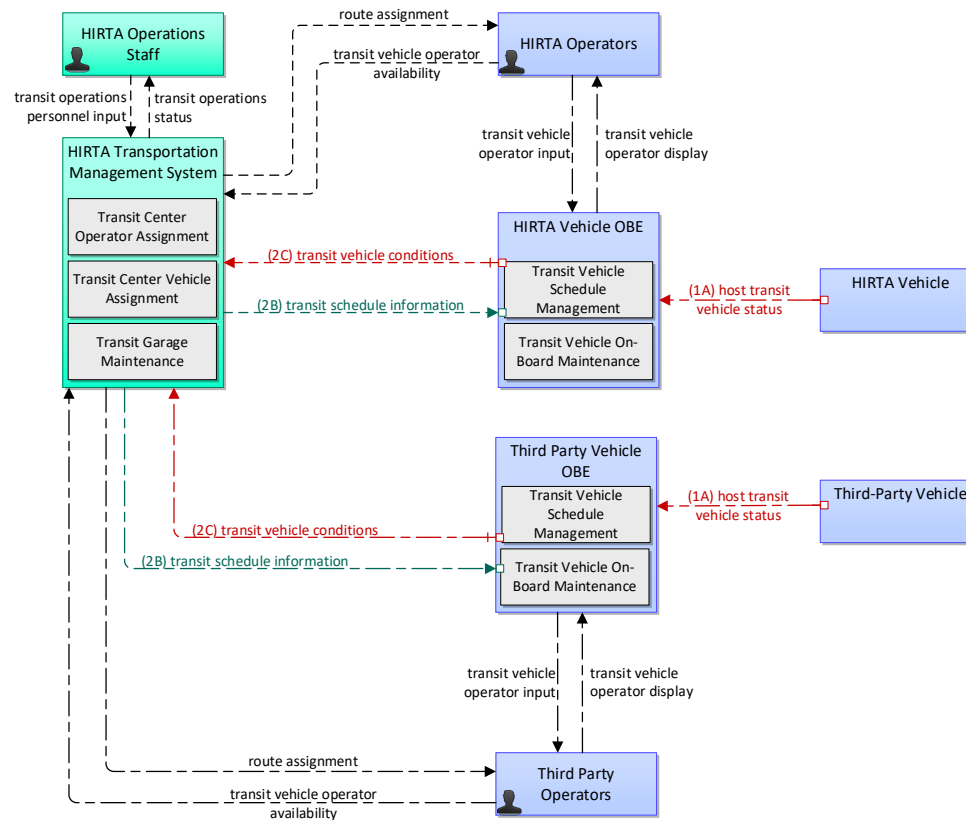
Figure 16. PT06: Transit Fleet Management (Source: HIRTA team)

This service package supports automatic transit maintenance scheduling and monitoring. HIRTA operations staff manage personnel and monitor vehicle conditions to assist with scheduling and monitoring of Health Connector trips, whether on HIRTA vehicles or third-party vehicles. While third-party maintenance does not occur through HIRTA, communication between HIRTA and third parties is represented by the transit scheduling and transit vehicle conditions flows.

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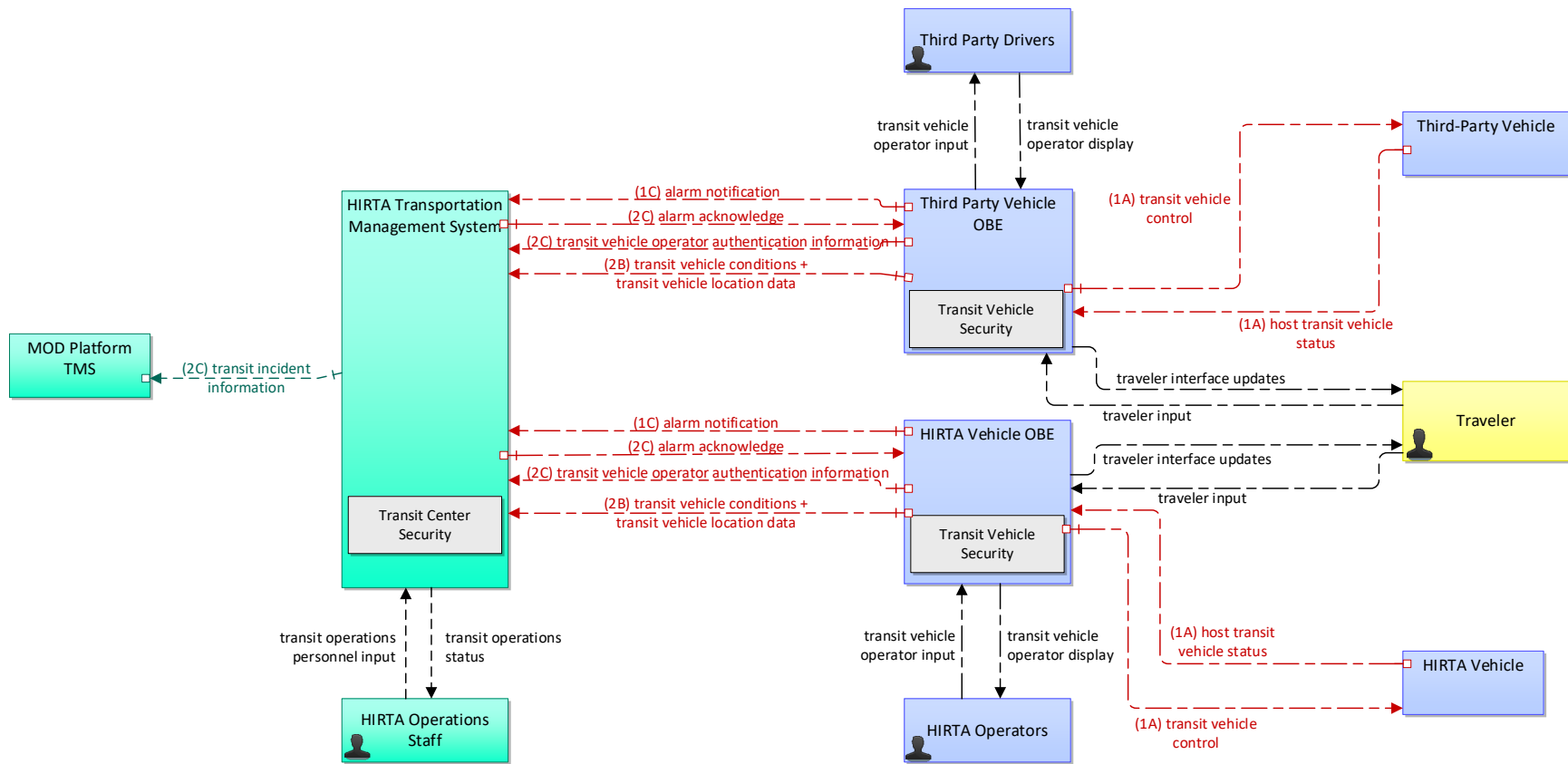
Figure 17. PT05: Transit Security (Source: HIRTA team)

This service package provides for the physical security of transit passengers and transit vehicle operators. On-board equipment performs surveillance and sensor monitoring to identify potentially hazardous situations. For HIRTA vehicles, this applies to any on-board security infrastructure including cameras and hardware that flags specific camera feed times for later review should an incident occur. For third-party providers, specific security criteria will be identified during the agreement process.

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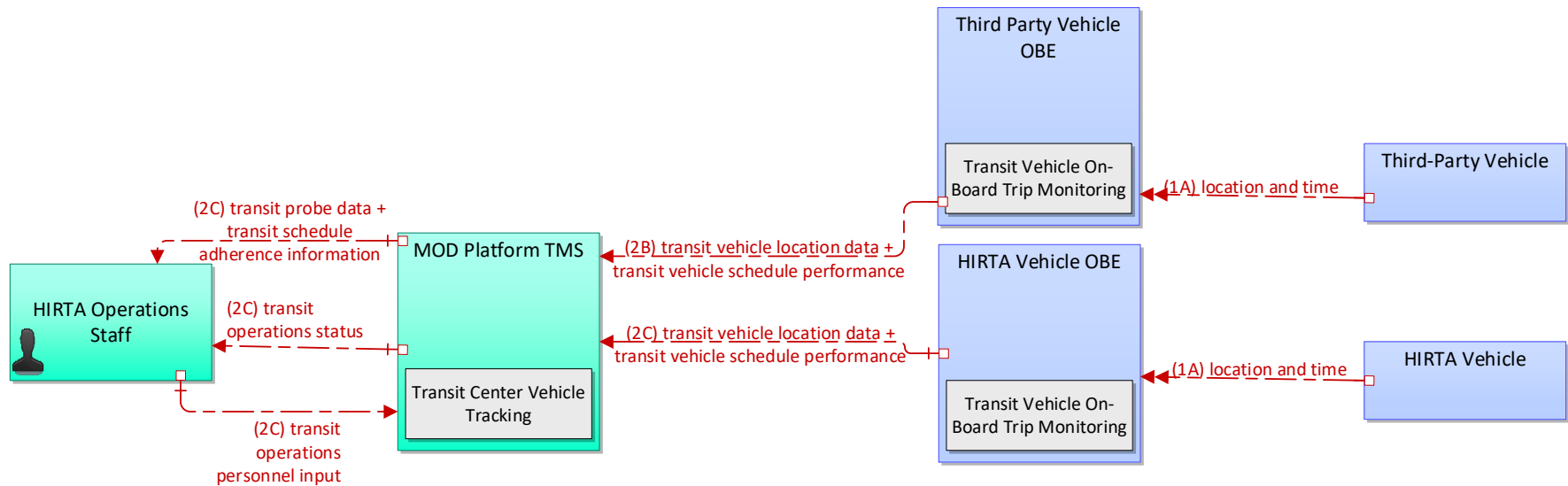
Figure 18. PT01: Transit Vehicle Tracking (Source: HIRTA team)

This service package monitors current transit vehicle location using an Automated Vehicle Location (AVL) System. The location data may be used to determine real time schedule adherence and update the transit system's schedule in real-time. HIRTA operations staff will be able to use the MOD platform to monitor the location of HIRTA vehicles as well as any third-party vehicles being used to make health connector trips.

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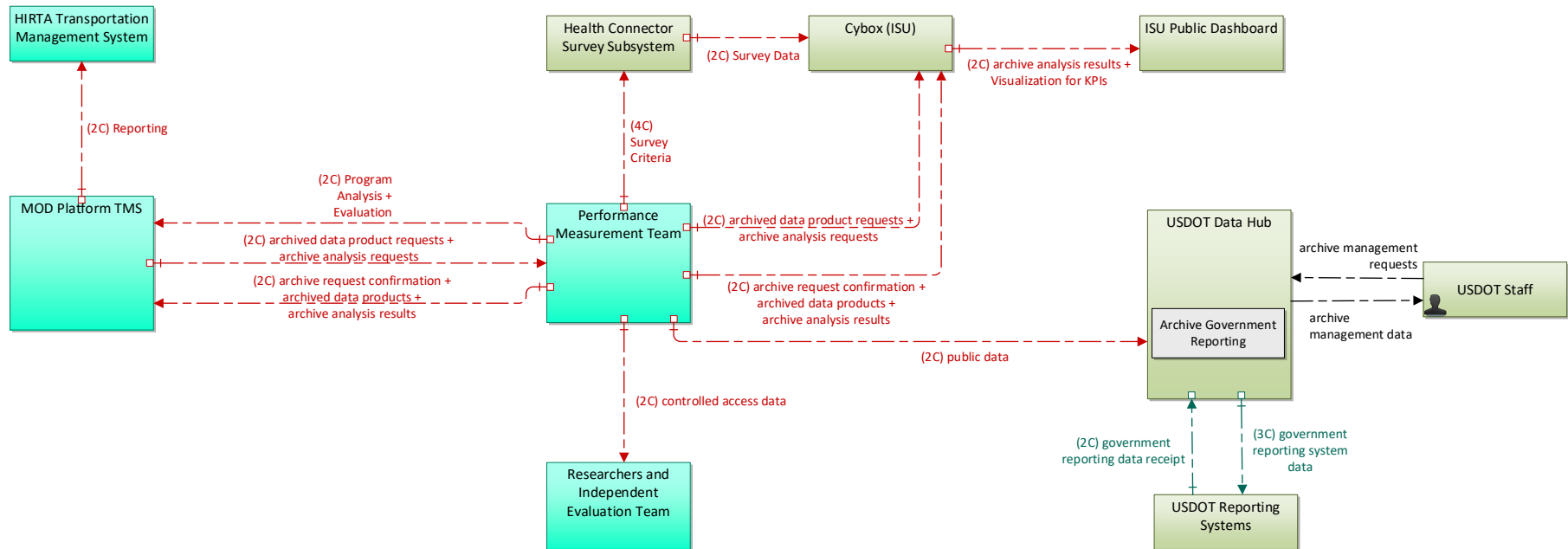
Figure 19. DM02: Performance Monitoring (Source: HIRTA team)

In this context, performance monitoring refers to data being collected and analyzed to evaluate project performance against stated project goals. The performance measurement team, ISU, plays a central role in this system, and HIRTA TMS acts as a central provider of data between both ISU and USDOT archive data repositories. This diagram also illustrates how data is cleaned and scraped of all PII before being shared with the USDOT Data Hub, which is publicly available.

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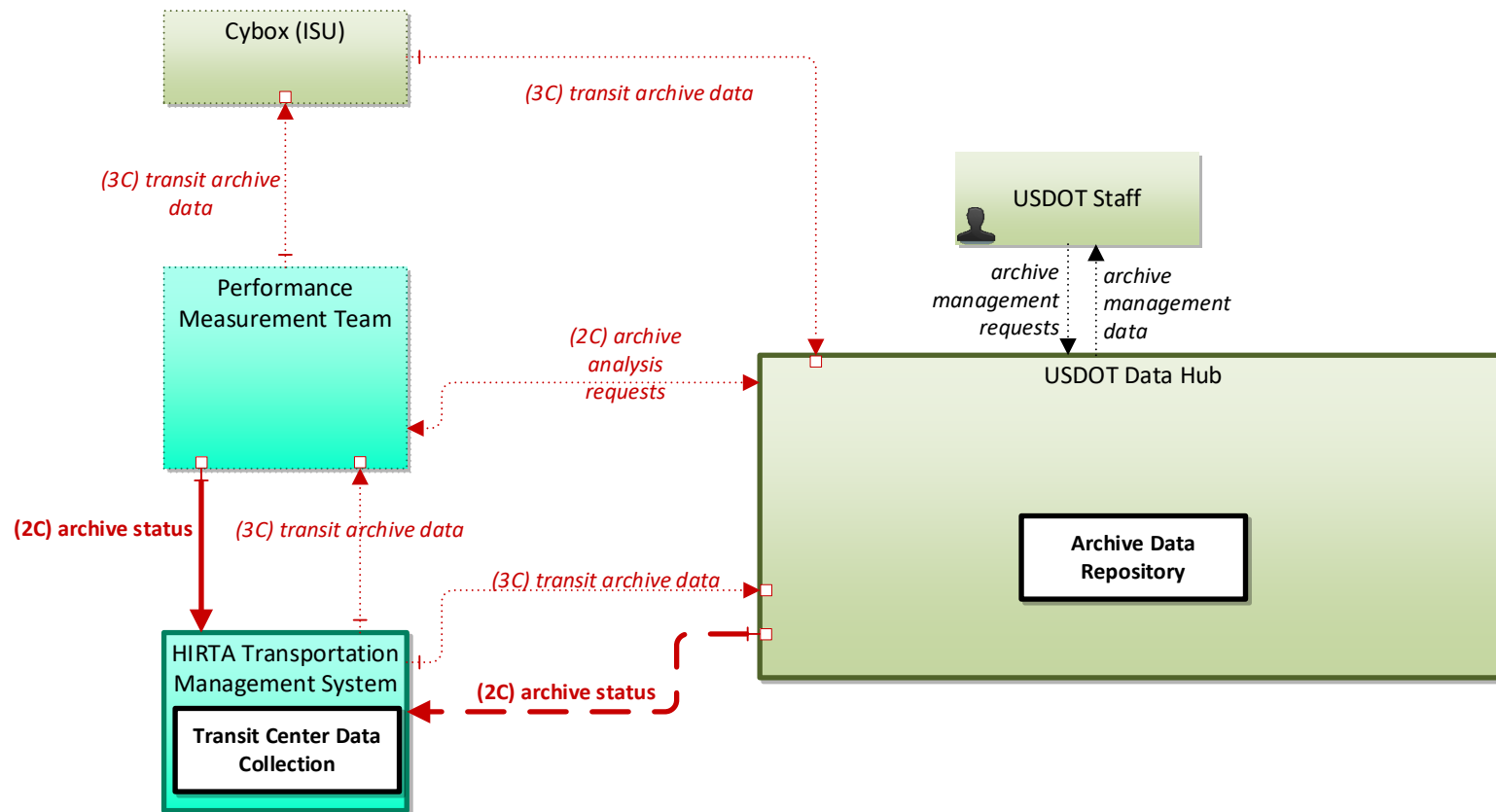
Figure 20. DM01: Data Warehouse (Source: HIRTA team)

DM01 provides archived data from the Health Connector project to USDOT for storage and research. Data is shared from HIRTA to the performance measurement team and then with funding and government partners.

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4.3 Functional View

The functional architecture views describe the abstract functional elements or processes and their logical interactions via data flows that satisfy the system requirements. Functional diagrams were developed by identifying subsystems, and then mapping elements, physical objects, and processes to those subsystems in Excel before drawing them in SET-IT. The team then confirmed that the system requirements are satisfied by the functional architecture represented in these views.
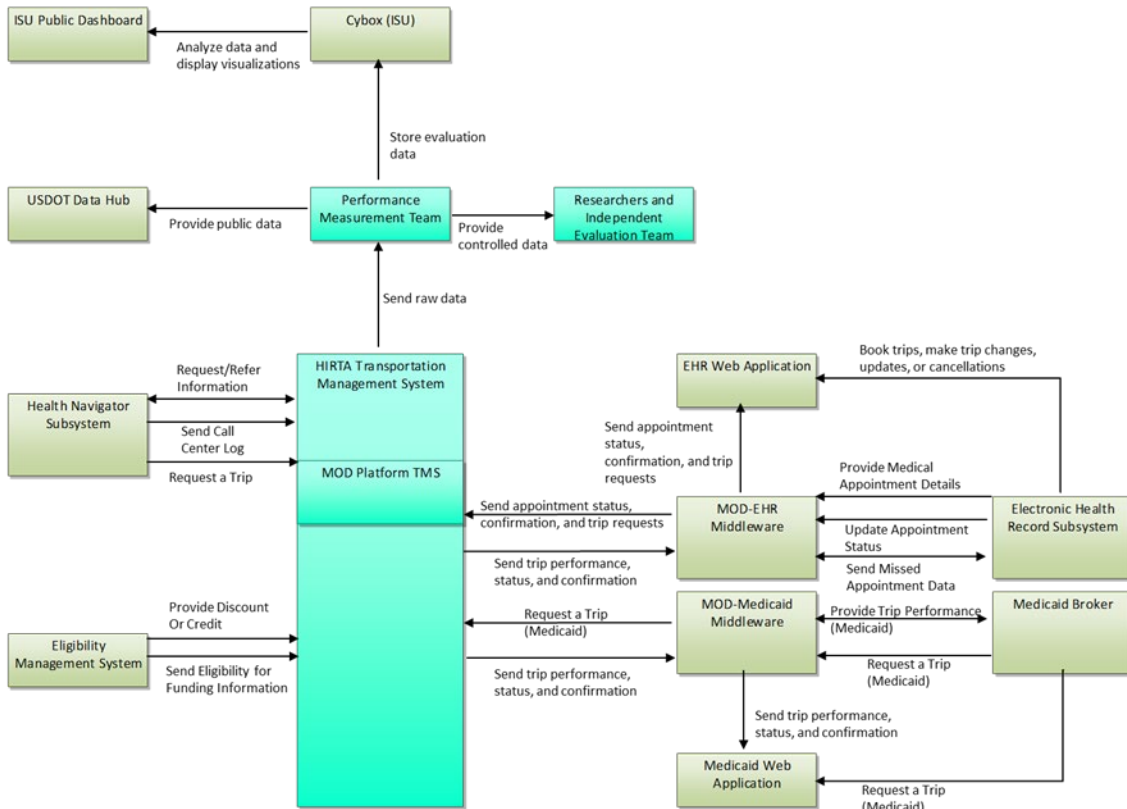
Figure 21. Transportation Management Subsystem (Source: HIRTA team)

This subsystem diagram includes the technologies used to assist customer care and operations staff with Traveler registration, eligibility management, reservations, scheduling, dispatching, billing, and administration activities. Further, this new software will support utilizing third-party service providers for adding capacity when needed in real-time. Finally, limited access to this software will be made available to health navigators and healthcare providers, so they are able to book trips directly without the involvement of HIRTA staff. Critical flows in this diagram include trip requests by health navigators or through the Medicaid broker, sharing of eligibility criteria, survey data interactions, and the sharing of medical appointment information that is critical to Health Connector. The TMS will be procured through the RFP process underway as of fall of 2022 and expected to be completed by December of 2022.

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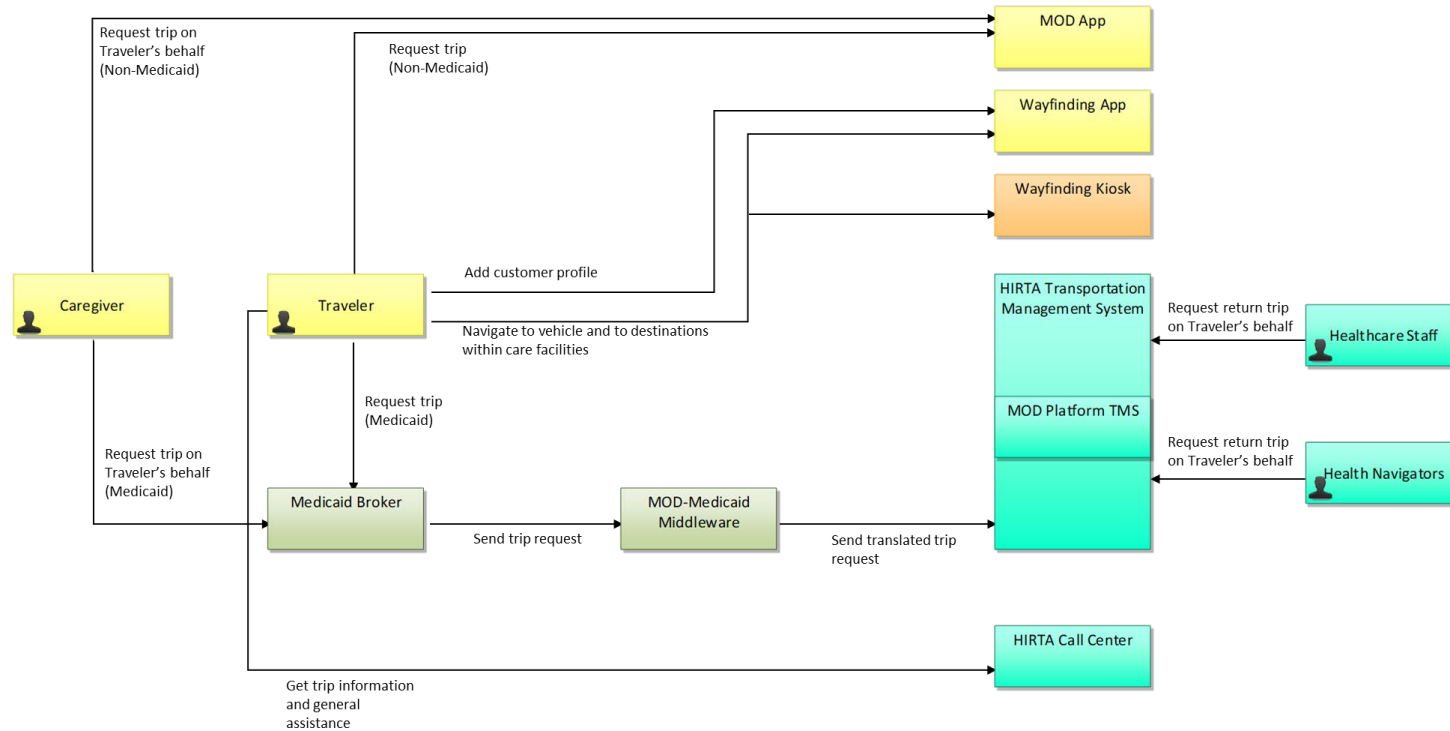
Figure 22. Traveler Subsystem (Source: HIRTA team)

This subsystem diagram includes the tools and technologies (phone/interactive voice response (IVR), mobile/smart devices, web-based tools) to be used by Travelers or patients seeking transportation services for their medical appointments as part of their pre-trip, during trip, on arrival, and return trip activities. Critical flows in this diagram show how travelers can book rides, either through a Medicaid broker, or separately through the MOD app. They are also able to utilize the HIRTA call center for booking or other assistance and have access to the wayfinding app and kiosks for navigation assistance. The Traveler subsystem will be procured through the RFP process described under TMS above.

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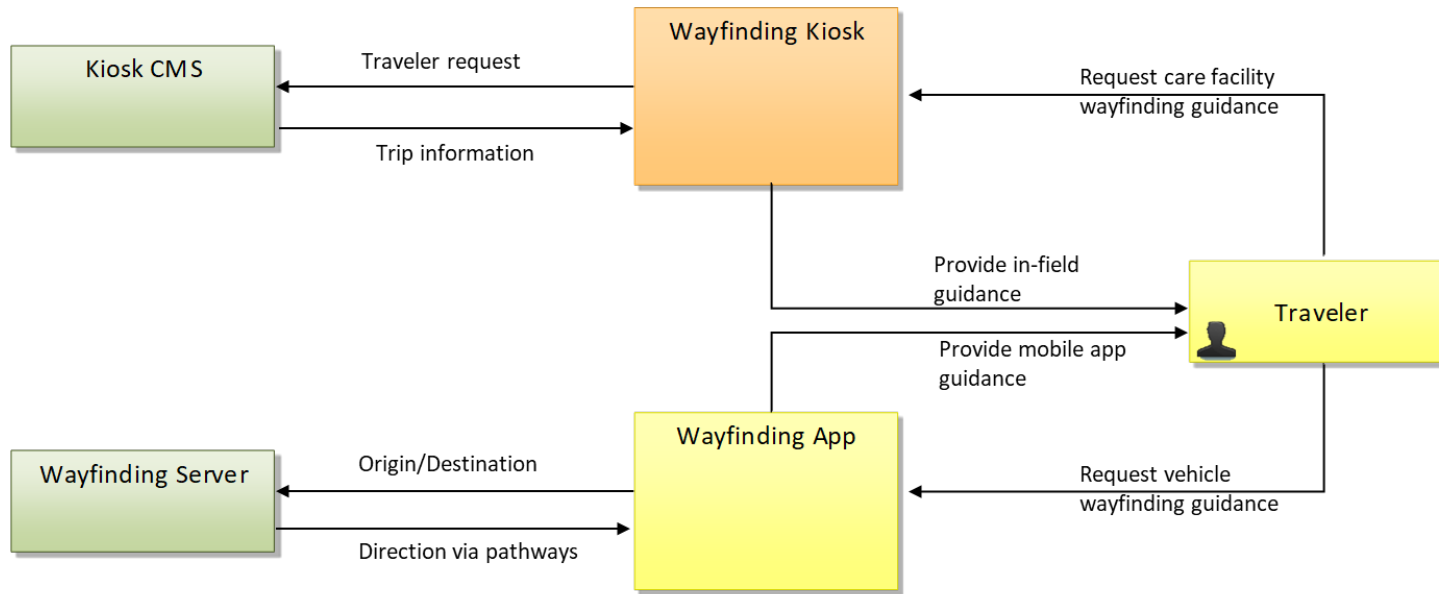
Figure 23. Wayfinding Subsystem (Source: HIRTA team)

This diagram refers to the technologies and infrastructure to be used for providing outdoor wayfinding, indoor positioning, orientation, and step-by-step guidance on request to Travelers. HIRTA Health Connector partner, NaviLens, will provide the wayfinding subsystem. Core core components of the wayfinding subsystem include wayfinding kiosks that will be in care facilities, and the central software that provides information to that equipment. Interaction with the traveler-end wayfinding app is also critical.

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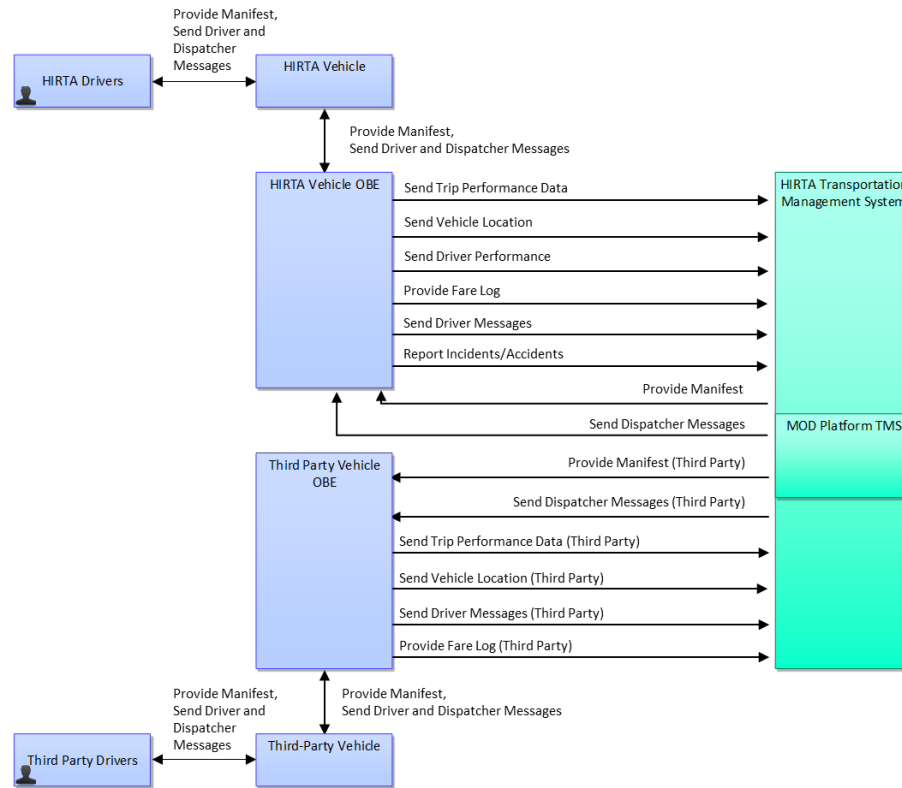
Figure 24. Vehicle Subsystem (Source: HIRTA team)

This diagram refers to the technologies deployed on vehicles to support driver-end functions for driver-dispatch communications, manifest management, support just-in-time dispatching, turn-by-turn navigation, on-board customer information, and fare payments. On all HIRTA-owned vehicles, drivers will use tablets running the driver app. On other vehicles, drivers may use the driver app on their tablet or their phone. The vehicle subsystem will be procured through the RFP process described under TMS above.

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4.3.1 Data and Information Flow View

This section has been combined with section 4.4 below to identify information flows as well as data standards and protocols.

4.4 Communications View

Table 7 shows the information flow triples within the Health Connector project. A preliminary assessment of solutions and standards for each triple is provided, however this information will continue to be updated as system design is developed in early 2023.

Table 8. Communications View Table

Flow	Source Element	Destination Element	Solutions/Standards
archive analysis requests	MOD Platform TMS	Performance Measurement Team	(None)
archive analysis requests	USDOT Data Hub	Performance Measurement Team	(None)
archive analysis results	Cybox (ISU)	ISU Public Dashboard	(None)
archive analysis results	Performance Measurement Team	Cybox (ISU)	(None)
archive analysis results	Performance Measurement Team	MOD Platform TMS	(None)
archive request confirmation	Performance Measurement Team	Cybox (ISU)	(None)
archive request confirmation	Performance Measurement Team	MOD Platform TMS	(None)
archive status	USDOT Data Hub	HIRTA Transportation Management System	US: ADMS - Secure Internet (ITS)

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Flow	Source Element	Destination Element	Solutions/Standards
archived data product requests	MOD Platform TMS	Performance Measurement Team	(None)
archived data products	Performance Measurement Team	Cybox (ISU)	(None)
archived data products	Performance Measurement Team	MOD Platform TMS	(None)
broadcast traveler information	MOD Platform TMS	HIRTA Vehicle OBE	TPEG2 - Wide Area Broadcast
broadcast traveler information	MOD Platform TMS	MOD App	TPEG2 - Wide Area Broadcast
broadcast traveler information	MOD Platform TMS	Third Party Vehicle OBE	TPEG2 - Wide Area Broadcast
demand response passenger and use data	HIRTA Vehicle OBE	HIRTA Transportation Management System	US: TCIP - Secure Wireless Internet (ITS)
demand responsive transit plan	HIRTA Transportation Management System	MOD Platform TMS	US: TCIP - Secure Internet (ITS)
demand responsive transit request	MOD Platform TMS	HIRTA Transportation Management System	US: TCIP - Secure Internet (ITS)
government reporting data receipt	USDOT Reporting Systems	USDOT Data Hub	US: ADMS - Secure Internet (ITS)
government reporting system data	USDOT Data Hub	USDOT Reporting Systems	US: ADMS - Secure Internet (ITS)
host transit vehicle status	HIRTA Vehicle	HIRTA Vehicle OBE	(None)
host transit vehicle status	Third-Party Vehicle	Third Party Vehicle OBE	(None)

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Flow	Source Element	Destination Element	Solutions/Standards
Information/referral requests	Health Navigator Subsystem	HIRTA Transportation Management System	(None-Data) - Secure Internet (ITS)
interactive traveler information	MOD Platform TMS	HIRTA Vehicle OBE	US: ATIS - Secure Wireless Internet (ITS)
interactive traveler information	MOD Platform TMS	MOD App	US: ATIS - Secure Wireless Internet (ITS)
interactive traveler information	MOD Platform TMS	Third Party Vehicle OBE	US: ATIS - Secure Wireless Internet (ITS)
Medical Appointment Change/Cancellation	Electronic Health Record Subsystem	EHR Web Application	(None-Data) - Secure Internet (ITS)
Medical Appointment Change/Cancellation	Electronic Health Record Subsystem	MOD-EHR Middleware	(None-Data) - Secure Internet (ITS)
Medical Appointment Change/Confirmation	MOD-EHR Middleware	MOD Platform TMS	(None-Data) - Secure Internet (ITS)
Medical Appointment Change/Confirmation	MOD-Medicaid Middleware	MOD Platform TMS	(None-Data) - Secure Internet (ITS)
Medical Appointment Information	Electronic Health Record Subsystem	EHR Web Application	(None-Data) - Secure Internet (ITS)

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Flow	Source Element	Destination Element	Solutions/Standards
Medical Appointment Information	Electronic Health Record Subsystem	MOD-EHR Middleware	(None-Data) - Secure Internet (ITS)
Patient Trip Requests	Health Navigator Subsystem	HIRTA Transportation Management System	(None-Data) - Secure Internet (ITS)
personal transit information	HIRTA Transportation Management System	MOD App	US: GTFS - Secure Wireless Internet (ITS)
Program Analysis + Evaluation	Performance Measurement Team	MOD Platform TMS	(None)
Reporting	MOD Platform TMS	HIRTA Transportation Management System	(None-Data) - Secure Internet (ITS)
secure center operator data	Remote Offices	VPN	(None)
secure center operator input	VPN	Remote Offices	(None)
service information request	MOD Platform TMS	HIRTA Transportation Management System	(None)
service information response	HIRTA Transportation Management System	MOD Platform TMS	(None)
shared use confirmation	MOD App	MOD Platform TMS	(None-Data) - Secure Wireless Internet (ITS)

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Flow	Source Element	Destination Element	Solutions/Standards
shared use request	MOD App	MOD Platform TMS	(None-Data) - Secure Wireless Internet (ITS)
shared use response	MOD Platform TMS	MOD App	(None-Data) - Secure Wireless Internet (ITS)
shared use status	MOD Platform TMS	HIRTA Transportation Management System	(None-Data) - Secure Internet (ITS)
transit and fare schedules	HIRTA Transportation Management System	MOD Platform TMS	US: (None-Data) - Secure Internet (ITS)
transit archive data	HIRTA Transportation Management System	USDOT Data Hub	US: ADMS - Secure Internet (ITS)
transit incident information	HIRTA Transportation Management System	MOD Platform TMS	US: (None-Data) - Secure Internet (ITS)
transit information user request	MOD App	HIRTA Transportation Management System	(None-Data) - Secure Wireless Internet (ITS)
transit schedule adherence information	HIRTA Transportation Management System	MOD Platform TMS	US: (None-Data) - Secure Internet (ITS)
transit schedule information	HIRTA Transportation Management System	HIRTA Vehicle OBE	US: (None-Data) - Secure Wireless Internet (ITS)

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Flow	Source Element	Destination Element	Solutions/Standards
transit traveler information	HIRTA Transportation Management System	HIRTA Vehicle OBE	US: (None-Data) - Secure Wireless Internet (ITS)
transit traveler request	HIRTA Vehicle OBE	HIRTA Transportation Management System	(None-Data) - Secure Wireless Internet (ITS)
transit traveler request	Third Party Vehicle OBE	HIRTA Transportation Management System	(None)
transit traveler request	Wayfinding Kiosk	Kiosk CMS	(None)
transit trip plan	HIRTA Transportation Management System	MOD Platform TMS	US: ATIS - Secure Internet (ITS)
transit trip request	MOD Platform TMS	HIRTA Transportation Management System	US: ATIS - Secure Internet (ITS)
transit vehicle conditions	HIRTA Vehicle OBE	HIRTA Transportation Management System	US: TCIP - Secure Wireless Internet (ITS)
transit vehicle location data	HIRTA Vehicle OBE	MOD Platform TMS	(None)
transit vehicle operator authentication information	HIRTA Vehicle OBE	HIRTA Transportation Management System	(None-Data) - Guaranteed Secure Wireless Internet (ITS)
transit vehicle operator information	HIRTA Transportation Management System	HIRTA Vehicle OBE	US: TCIP - Secure Wireless Internet (ITS)

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Flow	Source Element	Destination Element	Solutions/Standards
transit vehicle schedule performance	HIRTA Vehicle OBE	MOD Platform TMS	(None)
travel services information	Kiosk CMS	Wayfinding Kiosk	(None)
travel services information	MOD Platform TMS	HIRTA Vehicle OBE	US: ATIS - Secure Wireless Internet (ITS)
travel services information	MOD Platform TMS	MOD App	US: ATIS - Secure Wireless Internet (ITS)
travel services information	MOD Platform TMS	Third Party Vehicle OBE	US: ATIS - Secure Wireless Internet (ITS)
travel services request	HIRTA Vehicle OBE	MOD Platform TMS	US: ATIS - Secure Wireless Internet (ITS)
travel services request	MOD App	MOD Platform TMS	US: ATIS - Secure Wireless Internet (ITS)
travel services request	Third Party Vehicle OBE	MOD Platform TMS	US: ATIS - Secure Wireless Internet (ITS)
travel services request	Wayfinding Kiosk	Kiosk CMS	(None)
traveler alerts	MOD Platform TMS	HIRTA Vehicle OBE	US: ATIS - Wide Area Broadcast
traveler alerts	MOD Platform TMS	MOD App	US: ATIS - Wide Area Broadcast

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Flow	Source Element	Destination Element	Solutions/Standards
traveler alerts	MOD Platform TMS	Third Party Vehicle OBE	US: ATIS - Wide Area Broadcast
traveler input	Wayfinding App	Wayfinding Server	(None)
traveler input	Wayfinding Kiosk	Kiosk CMS	(None)
traveler interface updates	Kiosk CMS	Wayfinding Kiosk	(None)
traveler interface updates	Wayfinding App	Wayfinding Server	(None)
traveler interface updates	Wayfinding Kiosk	Kiosk CMS	(None)
traveler interface updates	Wayfinding Server	Wayfinding App	(None)
traveler request	Eligibility Management System	MOD Platform TMS	(None)
traveler request	HIRTA Vehicle OBE	MOD Platform TMS	US: ATIS - Secure Wireless Internet (ITS)
traveler request	MOD App	Eligibility Management System	(None)
traveler request	MOD App	MOD Platform TMS	US: ATIS - Secure Wireless Internet (ITS)
traveler request	Third Party Vehicle OBE	MOD Platform TMS	US: ATIS - Secure Wireless Internet (ITS)
Trip Booking Change/Cancellation	MOD Platform TMS	MOD-EHR Middleware	(None-Data) - Secure Internet (ITS)

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Flow	Source Element	Destination Element	Solutions/Standards
Trip Booking Change/Cancellation	MOD-EHR Middleware	Electronic Health Record Subsystem	(None)
trip confirmation	HIRTA Call Center	HIRTA Transportation Management System	(None-Data) - Secure Internet (ITS)
trip confirmation	HIRTA Vehicle OBE	MOD Platform TMS	(None-Data) - Secure Wireless Internet (ITS)
trip confirmation	MOD App	MOD Platform TMS	(None-Data) - Secure Wireless Internet (ITS)
trip confirmation	MOD Platform TMS	HIRTA Transportation Management System	(None-Data) - Secure Internet (ITS)
trip confirmation	MOD Platform TMS	MOD-EHR Middleware	(None)
trip confirmation	MOD Platform TMS	MOD-Medicaid Middleware	(None)
trip confirmation	MOD-Medicaid Middleware	Medicaid Broker	(None)
trip confirmation	Third Party Vehicle OBE	MOD Platform TMS	(None-Data) - Secure Wireless Internet (ITS)
trip feedback	HIRTA Vehicle OBE	MOD Platform TMS	(None-Data) - Secure Wireless Internet (ITS)

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Flow	Source Element	Destination Element	Solutions/Standards
trip feedback	MOD App	MOD Platform TMS	(None-Data) - Secure Wireless Internet (ITS)
trip feedback	Third Party Vehicle OBE	MOD Platform TMS	(None-Data) - Secure Wireless Internet (ITS)
Trip performance	MOD Platform TMS	MOD-EHR Middleware	(None)
Trip performance	MOD Platform TMS	MOD-Medicaid Middleware	(None)
Trip performance	MOD-Medicaid Middleware	Medicaid Broker	(None)
trip plan	MOD Platform TMS	HIRTA Vehicle OBE	US: ATIS - Secure Wireless Internet (ITS)
trip plan	MOD Platform TMS	MOD App	US: ATIS - Secure Wireless Internet (ITS)
trip plan	MOD Platform TMS	Third Party Vehicle OBE	US: ATIS - Secure Wireless Internet (ITS)
trip request	HIRTA Vehicle OBE	MOD Platform TMS	US: ATIS - Secure Wireless Internet (ITS)
trip request	MOD App	MOD Platform TMS	US: ATIS - Secure Wireless Internet (ITS)

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Flow	Source Element	Destination Element	Solutions/Standards
trip request	Third Party Vehicle OBE	MOD Platform TMS	US: ATIS - Secure Wireless Internet (ITS)
Trip Requests	Medicaid Broker	MOD-Medicaid Middleware	(None)
Trip Requests	MOD-EHR Middleware	MOD Platform TMS	(None)
Trip Requests	MOD-Medicaid Middleware	MOD Platform TMS	(None)
Trip status	MOD Platform TMS	Kiosk CMS	(None)
Trip status	MOD Platform TMS	MOD-Medicaid Middleware	(None)
Trip status	MOD Platform TMS	Wayfinding Server	(None)
Trip status	MOD-Medicaid Middleware	Medicaid Broker	(None)
user account setup	HIRTA Vehicle OBE	MOD Platform TMS	(None-Data) - Secure Wireless Internet (ITS)
user account setup	MOD App	MOD Platform TMS	(None-Data) - Secure Wireless Internet (ITS)
user account setup	Third Party Vehicle OBE	MOD Platform TMS	(None-Data) - Secure Wireless Internet (ITS)
user profile	HIRTA Vehicle OBE	MOD Platform TMS	(None-Data) - Secure Wireless Internet (ITS)

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Flow	Source Element	Destination Element	Solutions/Standards
user profile	MOD App	MOD Platform TMS	(None-Data) - Secure Wireless Internet (ITS)
user profile	Third Party Vehicle OBE	MOD Platform TMS	(None-Data) - Secure Wireless Internet (ITS)
visualization for KPIs	Cybox (ISU)	ISU Public Dashboard	(None-Data) - Secure Internet (ITS)

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5 References

[1] "Architecture Reference for Cooperative and Intelligent Transportation," ARC-IT v9.0, Oct. 13, 2021. https://www.arc-it.net/index.html (accessed May 10, 2022).

[2] Phase 1 Performance Measurement and Evaluation Support Plan (FHWA-JPO-21-877) https://rosap.ntl.bts.gov/view/dot/60580

[3] Phase 1 Concept of Operations (FHWA-JPO-21-859) https://rosap.ntl.bts.gov/view/dot/57469

[4] "INCOSE Systems Engineering Handbook", 4th Edition. 2015.

[5] Phase 1 Data Management Plan (FHWA-JPO-21-867) https://rosap.ntl.bts.gov/view/dot/61727

[6] Phase 1 Systems Requirements Specifications (SyRS) Document (FHWA-JPO-21-882) https://rosap.ntl.bts.gov/view/dot/61724

[7] Phase 2 Data Management Plan, to be published

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Appendix A. Definitions, Acronyms, and Abbreviations

Term	Name	Description
Access2Care		A transportation broker for State of Iowa Medicaid program that performs booking and scheduling and works with service providers such as HIRTA for successful delivery of Medicaid-eligible trips.
API	Application Programming Interface	Software middleware that allows two devices or applications to exchange data with each other. APIs will be used between the MOD platform and EHR system, as well as between the MOD platform and Access2Care.
ARC-IT	Architecture Reference for Cooperative & Intelligent Transportation	Provides a framework for planning, programming, and implementing intelligent transportation systems.
DCHD	Dallas Country Health Department	One of the project Partners who will lead integration with healthcare services.
EHR	Electronic Healthcare Record	Refers to the healthcare information management system used by hospitals for patients' healthcare-related appointments, transactions, and records management.
ISU	Iowa State University	Iowa State University is a public research university with multiple campuses in the State of Iowa and will be engaged as the research and evaluation partner in Phases 2 and 3.
MOD	Mobility on Demand	Type of platform that allows Travelers to book on-demand trips and operators to assign drivers and vehicles in real time.
OBE	On Board Equipment	
SAD	System Architecture Documents	
SET-IT	Systems Engineering Tool for Intelligent Transportation	Visio based tool from USDOT for creating ITS diagrams.
SOI	System of Interest	
SYRS	System Requirements	
TMS	Transportation Management System	All systems and tools to be used by HIRTA for managing day-to-day delivery of transportation services.
USDOT	United States Department of Transportation	
VPN	Virtual Private Network	Used to access remote workspaces.

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Appendix B. Standards Plan

The following data standards were identified during Phase 1 and continue to govern data in Phase 2/3. These standards will continue to be developed with input from the MOD vendor during the system design portion of Task 2-B.

Data Standards

A list of standards, as applicable to vehicle, central environment, and data access and sharing are discussed in the following subsections.

Vehicle Data Standards

Currently, the only planned vehicle equipment is a tablet or a mobile device for drivers that will exchange data over cellular data network.

HIRTA team also plans to explore the potential to provide advanced infotainment service on vehicles to provide information to travelers (e.g., orientation information upon arrival at the hospital). This was identified as a low priority need during the Phase 1 ConOps stage. However, it is included as an optional requirement based on subsequent stakeholder discussions, and the implementation approach (e.g., hardware and content management) will be revisited during design stage as part of Phase 2.

None of the planned features require a vehicle area network (VAN) except obtaining real-time status on wheelchair availability. Fault codes can be received over Society of Automobile Engineers (SAE) J1939 network if a wheelchair lift interlock module is available on a vehicle. Based on system requirements discussion, the need for real-time monitoring of such failure is not considered essential.

Data Communication Standards

Vehicle-to-central communication will be accomplished using Internet Protocol (IP)-based transport protocols, Transmission Control protocol (TCP) or User datagram Protocol (UDP). Data transport will occur over a 4G or 5G network with a carrier-level encryption using a private Access Point Name (APN).

Data Access Protocols

At least the following protocols will be used:
- HTTPS: Hypertext Transfer Protocol Secure (HTTPS) will be used for accessing data over the web or mobile browsers.
- Secure Socket Layer (SSL)-based security as provided at OS-level will be used by mobile apps.
- SFTP: Secure file transfer protocol (SFTP) will be used to provide access to open data from HIRTA's local data center.

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Data Sharing Standards

Data will be shared using the following standard formats:

- CSV: non-spatial data will be shared using text-based files using CSV format. Files will include a header and data. Details on the header fields will be available in the metadata.
- JSON: TMS reporting portal currently makes spatial data available over JSON and the same practice will be used for sharing spatial data.
- SHP: Shape file format may be used for sharing spatial analysis conducted using survey data.

Open Data Standards for Transactional Data

Open data, currently in practice in the transit industry, is applicable to fixed-route services only, to openly share data related to information oriented towards travelers. For Health Connector, which will be a demand response service, the only applicable standard is GTFS-flex. GTFS-flex is limited to trip planning for demand response services and is mostly useful when multiple agencies are involved given the effort required in putting together the feed. After evaluating the use cases for this project, we determined we would not use GTFS-flex..

Overall, open data-based exchange is not applicable to this project, since there is currently no transactional data standard for functions such as booking, service management, or payment in use for demand response services in the industry. Existing and planned open data standards for transactional information, General On-Demand Feed Specification (GOFS) or Transactional Data Standard (TDS), are still not ready for mainstream deployment based on our assessment. The HIRTA team will continue to monitor that development for Phase 2 but are currently taking the open API approach for interfacing with external systems (Access2Care, EHR system, or third-party service providers). This approach may differ for other agencies looking to replicate the Health Connector concept, since MOD vendors may be different, and other providersor subsystems could be included. Nevertheless, the core of HIRTA's system architecture will still be replicable for other sites, even if specific standards differ.

Exchange with the wayfinding system will be done using a standard format based on GTFS-pathways, which has been adopted for outdoor and indoor wayfinding by transit industry. However, officially there is no standard for indoor environment beyond the transit industry.

Open API

Interfaces with Access2Care and Epic EHR are planned to use the Health Connector middleware.

Epic's open API will be needed to access medical appointment data. Details of the API are available at https://open.epic.com/ (accessed Aug 2021). Epic APIs are also compliant with Fast Health Interoperability Record (FHIR) and use eXtensible markup language (XML) or JSON for data exchange.

Versioning

Datasets released at a particular interval (e.g., daily, monthly) will follow a naming convention so it is easily identifiable by users. Also, datasets will be accompanied by metadata so users are

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able to determine information on what is included. If there are any changes in the data structure between versions, it will be identified in the metadata. The DMP will be updated accordingly. Further details on metadata update process are described in the Phase 1 Data Management Plan.

Change and release management policies govern the release of updated versions for the system.

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